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Abstract

This study is concerned with a comparison of the organization of mental abilities of two African ethnic groups, the Venda and the Pedi, under conditions of experimental control over the variables of mean sample age and educational achievement. The influence of factors associated with tribal affiliation on cognitive test performance was studied by means of two independent investigations which permitted study of the interaction of tribal affiliation with both urbanization and education. Samples were compared in terms of performance on a battery of 10 identical cognitive tests. Conclusions were drawn largely from the results of difference between means tests and analyses of test-intercorrelations and covariance matrices. Factor analysis was not found to be an appropriate technique of analysis in the present study. Factor analytic findings were hence cautiously stated. The conclusion was reached that the contribution of traditional Pedi or Venda culture towards facilitating or impeding adaptation to an urban-industrialized way of life is negligible in comparison with such factors as formal education and industrial experience. It was concluded therefore that traditional culture had no direct bearing on cognitive test performance insofar as the measurement of adaptability to a western technological culture is concerned, but at the same time, it was argued that cultural values assert their influence indirectly on test performance measures by way of work-preferences which differed in the two tribal groups. The hypothesis was advanced that where employment and educational opportunities are equal for members of different tribal groups, and where members of these groups express similar job-preferences, subtle differences between the indigenous cultures in Southern Africa will be expected to play a minor role in influencing the cognitive correlates of adaptation to a western technological culture.

INDEX PAGE

.../2

Summary

The objective of the study was to compare the organization of mental abilities of two distinct African cultural groups with the view of identifying the factors associated with tribal affiliation which facilitate or impede adaptation to the demands of western technological society. Samples of adult male Vendas and Pedis were selected from subject pools previously investigated under the sponsorship of the International Biological Programme, (I.B.P.) and were matched in terms of mean age and educational achievement. Two separate matched samples were drawn: the first consisted of a sample of 396 subjects divided into four groups of 99 subjects each and representing the following populations: Rural Venda; Urban Venda; Rural Pedi; and Urban Pedi. This sample enabled the study of interaction of tribal affiliation and urbanization under conditions of control over age and education. The second sample comprised 304 subjects divided into four population groups of 76 subjects each: Venda Illiterate; Pedi Illiterate; Venda Literate, and Pedi Literate. By means of this sample, study of the interaction of tribal affiliation and education under conditions of control over age, urbanization and, for literates, education, was enabled.

Venda and Pedi groups were compared on a battery of 10 cognitive tests, which had been administered to both ethnic samples in previous studies. Statistical analyses included a comparison of mean test performance for each test in the battery between the various matched samples; comparisons of test-inter-correlation and covariance matrices; and factor analysis of test-intercorrelations pertaining to both the total sample and to each experimental group separately.

Comparisons made between the two ethnic groups prior to matching of the samples for mean age and education indicated a large measure of superiority in individual test performance on the part of the Pedi. The effect of matching in terms of these variables

...../ (ii)

was such that differences in mean test scores favouring the Pedi were not altogether eliminated. Even after matching, Rural Pedis were found to score significantly higher than Rural Vendas on three of the sub-tests included in the General Adaptability Battery (G.A.B.). Comparison of covariance matrices for Rural Pedis and Rural Vendas indicated furthermore that significant differences existed between these two groups. The conclusion was reached that the differences observed could be attributable to the differing work histories of the two groups in that Rural Pedis had gained considerable industrial experience on the gold-mines of the Witwatersrand while this was not true of their Venda counterparts. Furthermore, it was demonstrated empirically that such industrial experience was associated with a significant difference in the structure of mental abilities for the two groups which was interpreted as evidence that mining experience could be a factor promoting the differentiation of mental abilities of pre-literates.

Test scores on two measures of conceptual reasoning processes (including the Form Series Test) were shown to be significantly higher for Illiterate Pedis than for Illiterate Vendas. However this finding was not paralleled by differences in test covariance structure between the two groups. It was concluded in respect of this particular finding that factors attributable directly to traditional culture could not be pinpointed precisely, but it was suspected that the source of significant variation between the mean test scores concerned could be located in the urban segment of the illiterate Pedi sample. It was speculated that a more progressive outlook towards securing a livelihood in the city on the part of the illiterate Pedis favoured the development of certain conceptual reasoning processes. In this respect, traditional Vendas were looked upon as being more resistant to cultural change than were their Pedi counterparts.

....(iii)

Comparison of mean test scores and covariance matrices between Pedi and Venda literates and between Urban Pedis and Vendas indicated that there were no significant differences between samples. It was concluded that acculturation serves the function of overriding any initial advantages which the one tribal group may have had over the other in unacculturated comparisons by providing a situation where work-and educational-opportunities are equal for all regardless of tribal affiliation. This conclusion is again borne out when the tremendous importance of urbanization and education alone to cognitive performance is demonstrated. Within both tribal groups, education and urbanization were shown to result in a significant improvement in test performance as compared with performance by illiterates and rural individuals. However, only in the case of the Venda literate by illiterate comparison was it shown that improvement in test performance was accompanied by a significant change in the structure of intellect.

The overall conclusion reached was that the role of traditional culture in facilitating or impeding cognitive development is of lesser importance than are such factors as employment opportunities, work histories and experience and education. Where equality of opportunity on all these factors exists, it is confidently expected that differences in cognitive test performance between various ethnic groups in South Africa will be negligible. This would hold true for both urban and rural populations. It was also concluded that while traditional culture does not have a direct bearing on a test-score, the cultural values and attitudes towards certain avenues of employment do influence indirectly the cognitive adaptability of Africans. This argument was demonstrated by reference to tribal work preferences, in particular preferences relating to mining employment wherein Vendas hold a variety of beliefs which prevent them from actively taking up employment on the mines, thereby not permitting themselves to gain

...../(iv)

valuable experience which contributes towards overall cognitive adaptability.

Unfortunately, these conclusions are based on a comparison of two tribal groups only, together accounting for little over 14% of the total Bantu population of South Africa. Further research across all ethnic groups would have to be conducted in order to demonstrate more fully that factors other than traditional culture are the important agents facilitating or inhibiting successful adaptation. This does not imply that traditional culture is altogether an unimportant factor. It is however relatively less important than education and work experience in the context of explaining cognitive differences between tribes.

Opsomming

Hierdie studie is gemoeid met die vergelyking van die organisasie van verstandelike vermoëns van twee Bantoe-stamme ten einde die faktore verwant aan stamaffiliasie wat aanpassing tot 'n westerse tegnologiese kultuur vergemaklik of verhinder, te kan identifiseer. Steekproewe volwasse manlike Vendas en Pedis is gekies vanuit steekproewe wat tevore ondersoek is met die ondersteuning van die Internasionale Biologiese Program (I.B.P.) en is gepaar volgens ouderdom en aantal jare skoolopleiding. Twee afsonderlike gepaarde steekproewe is geneem: die eerste bestaan uit 396 persone wat in vier groepe van 99 persone elk verdeel is en wat die volgende populasies verteenwoordig: Landelike Venda; Stedelike Venda; Landelike Pedi; en Stedelike Pedi. Deur middel van hierdie ondersoek is daar gepoog om die wisselwerking van stamaffiliasie en verstedeliking vas te stel - gegee dat ouderdom en skoolopleiding konstant gehou word. Die tweede steekproef bestaan uit 304 persone verdeel in vier populasie-groepe van 76 persone elk: Ongeletterde Venda; Geletterde Venda; Ongeletterde Pedi; en Geletterde Pedi. Deur hierdie steekproef te bestudeer is die wisselwerking van stamaffiliasie en skoolopleiding onder toestande van gekontroleerde ouderdom, verstedeliking en, in die geval van geletterdes, ook skoolopleiding, bepaal.

Venda- en Pedi-groepe word vergelyk volgens prestasie op 'n battery van 10 kognitiewe toetse wat tevore op albei etniese steekproewe toegepas is. Statistiese ontledings sluit in die vergelyking van gemiddelde toetsprestasie vir elk van die toetse in die battery tussen die verskillende gepaarde Steekproewe; vergelykings van toetsinterkorrelasie - en kovariansiematryse; en faktoranalise van die interkorrelasies wat beide die totale steekproef en die aparte eksperimentele groepe betref.

Voor afparing van die steekproewe in terme van ouderdom en skoolopleiding, het vergelykings tussen Pedi en Venda op hoër toets-prestasies vir die Pedi-groepe gedui. Afparing volgens hierdie verandelikes het die hoër gemiddelde toetsprestasies van die Pedi nie heeltemaal verwyder nie. Selfs na paring blyk dit dat Landelike Pedis

..../ (vi)

betekenisvol hoër toetstellings as Landelike Vendas in die geval van drie subtoetse in die Algemene Aanpassingsbattery (G.A.B.) behaal het. Vergelyking van kovariansiematryse vir Landelike Pedis en Vendas dui boonop op betekenisvolle verskille tussen die twee groepe. Die gevolgtrekking word gemaak dat die waargenome verskille toegeskryf kan word aan verskillende werkgeskiedenisse van die twee groepe aangesien Landelike Pedis aanmerklike industriële ondervinding op die Witwatersrandse goudmyne opgedoen het terwyl dit nie die geval met Landelike Vendas was nie. Daar word verder aangetoon dat sodanige industriële ondervinding verwant mag wees aan die betekenisvolle verskil in die struktuur van verstandelike vermoëns van die twee groepe. Hierdie bevinding word vertolk as 'n bevestiging van die hipotese dat mynondervinding moontlik 'n faktor is wat die differensiasie van verstandelike vermoëns van tradisionele Bantoes kan bevorder.

Toetstellings op twee konseptuele redeneertoetse (insluitend die Vormreekstoets) was aansienlik hoër in die geval van Ongeletterde Pedis as in die geval van Ongeletterde Vendas, maar hierdie bevinding word nie versterk deur die waargenome verskille tussen toetskovariansie-strukture van die twee groepe nie. Uit hierdie bevindings was dit egter nie moontlik om die oorsake van die verskille in toetsprestasies na interkultuur verskille te herlei nie. Die verskil kan eerder toegeskryf word aan faktore verwant aan verstedeliking, dit wil sê, die verskil is tussen Stedelike Ongeletterde Pedis en Stedelike Ongeletterde Vendas. Daar word gespekuleer dat 'n meer progressiewe houding teenoor diensaanvaarding in die stede in die geval van Ongeletterde Pedis die ontwikkeling van sekere konseptuele redeneerprosesse mag bevoordeel. In hierdie verband, is dit moontlik dat tradisionele Vendas meer weerstand as tradisionele Pedis aan kultuurverandering bied.

Vergelyking van gemiddelde toetstellings en kovariansiematryse tussen Pedi en Venda geletterdes en tussen Stedelike Vendas en Stedelike Pedis toon geen beduidende verskille nie. Die gevolgtrekking

..../ (vii)

word gemaak dat akkulturasie enige aanvanklike kognitiewe voorsprong van een tradisionele etniese groep bo 'n ander nivelleer. Hierdie gevolgtrekking word weer gestaaf wanneer die belangrikheid van verstedeliking en skoolopleiding afgesien van stamaffiliasie vir kognitiewe prestasie aangetoon word. In albei etniese groepe word daar bewys dat verstedeliking en skoolopleiding 'n aanmerklike verbetering van toetsprestasie veroorsaak in vergelyking met die prestasies van ongeletterdes en landelike persone. Daar word egter slegs in die geval van Vendas aangetoon dat verbetering van toetsprestasie as gevolg van geletterdheid deur 'n betekenisvolle verandering in die struktuur van intellek vergesel word.

Die finale gevolgtrekking word gemaak dat die rol van tradisionele kultuur in soverre as wat kognitiewe ontwikkeling vergemaklik of verhinder word van minder belang blyk te wees as faktore soos werksgeleentheid, werkgeskiedenis, ondervinding en skoolopleiding. Indien hierdie faktore gelyk gestel sou word, word verwag dat kognitiewe toetsverskille tussen verskillende Suid-Afrikaanse etniese groepe gering sou blyk te wees. Hierdie sou geld vir beide stedelike en landelike bevolkings. Die gevolgtrekking word ook gemaak dat alhoewel tradisionele kultuur nie 'n <u>direkte</u> verband met toetstellings het nie, die kognitiewe aanpasbaarheid van Bantoes tog deur hulle kulturele waardes en houdings teenoor sekere werksgeleenthede beïnvloed word. Hierdie argument word toegelig met verwysing na die werksvoorkeure van die onderskeie stamme met spesifieke verwysing na houdings ten opsigte van mynwese. In hierdie verband blyk dit dat Vendas 'n verskeidenheid menings toegedaan is wat hulle verhinder om werk by die myne te aanvaar met die gevolg dat hulle nie aan die waardevolle ondervinding blootgestel word wat kognitiewe aanpasbaarheid bevorder nie.

Ongelukkig is hierdie gevolgtrekkings slegs op die vergelyking van twee etniese groepe gebaseer. Die Venda en die Pedi verteenwoordig ongeveer slegs 14% van die totale Bantoe bevolking van Suid-Afrika. Verdere ondersoek onder <u>alle</u> etniese groepe sou onderneem moes word om vas te stel of faktore bo en behalwe

..../ (viii)

tradisionele kultuur die belangrikste rol by suksesvolle aanpassing speel. Dit impliseer nie dat tradisionele kultuur onbelangrik is nie. Dit is egter van relatief minder belang as skoolopleiding en werksondervinding in die konteks van kognitiewe verskille tussen die Bantoe stamme.

Introduction

As part of South Africa's contribution to the Human Adaptation Section of the International Biological Programme (I.B.P.) two cognitive studies on distinct African cultural groups, the Venda and the Pedi, were carried out. The aim of these studies was to investigate changes that could be expected to occur in the organization of mental abilities of a group of people who are in a process of cultural change from a traditional-rural to an urban-industrialized way of life. Both investigations (Grant,[1] 1969a; Kendall,[2] 1971) concluded that formal education was a powerful means of adaptation to an essentially technological culture whereas urbanization (in the case of the Venda Study) or urban industrial experience (in the case of the Pedi) were shown to be of relatively smaller significance within the limits posed by the experimental design.

Literacy and urbanization are but two of the many and varied cultural factors which assist the modern African in his adaptation to a changing environment; but the contribution of the values and beliefs of the traditional culture in facilitating or impeding such adaptation could also be of importance. For this reason, it would useful to compare and contrast the changes that occur in the organization of mental abilities as a function of acculturation in two different African ethnic groups.

Several preliminary impressions have been gained of possible Venda-Pedi differences in cognitive efficiency. The implications of these impressions are limited however by the fact that Venda and Pedi samples are not comparable in respect of mean age, educational achievement and degree of urbanization, to mention but three important variables. Consequently, it will be necessary to exercise as much direct control as is possible over these three variables before attempting to seek cognitive differences attributable to traditional culture, or other relevant factors.

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1.1 Aim of the Study

- To draw samples of Venda and Pedi adult males matched in terms of age, education and degree of urbanization.

- To compare these samples on two measures of cognitive performance:

(i) the absolute level of performance on an identical battery of cognitive tests and

(ii) the interrelationships between the tests and between the abilities they presumably describe.

Such comparisons will take the form of both within-tribe comparisons and between-tribe comparisons. In the case of within-tribe comparisons, the effects of urbanization and literacy on cognitive performance will be studied and will be compared with the findings of the I.B.P. studies that have already been published, but where no attempt was made to control for significant age and education differences in the experimental samples concerned.

1.2 The problem of ethnic comparability

There have been few significant attempts in South Africa to compare ethnic performances on standard batteries of tests. A survey of the relevant literature reveals little conclusive support for either accepting or rejecting the hypothesis of tribal cognitive differences. Three studies have been carried out on large, but tribally unrepresentative samples of mine workers. The first was a study by Gouws[3] (1950) which seemed to support a theory prevalent at the time among mining officials that tribes from Southern Mozambique, in particular the Shangaans, were " more intelligent " than South African tribes. This observation was based on the fact that Mozambique tribes were over-represented in the higher skill-grade mining jobs and that their scores on the General Adaptability Battery (G.A.B.) were significantly higher than those of other tribal groups. Later studies by Hudson[4] (1953)

...../3

and Naude[5] (1962) again pointed to the apparent superiority of Mozambique tribes over all others employed on the mines, but such differences as were observed were to some extent reduced when age, education and mining experience were held constant for each ethnic group. Furthermore, these three variables were shown to bear stronger relationships with test performance than did tribal affiliation alone. Thus, for instance, greater differences in cognitive performance were reported between novice recruits on the one hand and experienced workers of mixed ethnic background on the other than was the case between Shangaans and members of any other tribal group.

Finally, in a more recent study which was undertaken by the author as part of an investigation for an industrial sponsor, mean test performances of samples of carefully selected Shangaans and Xhosas were compared. These samples were selected from the total intake over one month of recruits on one mine and were matched for age, education and length of previous mining experience. Comparisons were made between scores on the new Classification Test Battery (C.T.B.) and it was found that differences between mean scores for the two tribal samples were not statistically significant.

The above four investigations serve to illustrate several problems pertaining to valid comparisons between ethnic groups in respect of test performance. In the first place, it is essential to ensure that tribal samples are reasonably representative of the total population. Investigation of mine recruits alone introduces considerable bias into comparative studies. In this respect, Gouws[6] (1950) has cautioned against extrapolation from his findings to possible tribal differences in the wider community. In the case of apparent Shangaan superiority in performance on the G.A.B. it could be argued that the result is due, in part, to the role which work opportunity plays in biassing comparative samples. Employment

..../4

opportunities were limited in Mozambique in the '50s and '60s which compelled the " intellectual cream" of rural Shangaan society to take up mining employment in South Africa. Members of South African tribes on the other hand found it relatively easier to gain industrial employment in urban areas, mostly on a contract labour basis, but in many cases on a permanent urban-residence basis as well. It was possibly the relatively less progressive African who gravitated to the gold mines and it was against this individual that the Shangaans' performance was compared. On the basis of the above remarks, employment opportunity may be seen as an important selective factor in a consideration of the representativeness of tribal samples that have in the past been used to demonstrate tribal differences in terms of mental ability. Similarly, the work histories and preferences of different tribal groups are also factors which could cloud the issue of tribal comparison, thereby making it more difficult to demonstrate the contribution of the traditional tribal culture per se to Human Adaptation. Finally, in so far as test scores themselves are concerned, the minimum requirements for valid tribal comparisons would be to control such variables as age and educational achievement in a manner that their means and variances do not differ significantly from one sample to the other. This was not achieved in the case of many of the analyses performed by previous authors.

It is to be noted that our prime concern in the present study is to investigate the factors which may account for differences between ethnic groups in respect of their adaptation to different cultural circumstances. The author expresses considerable doubt as to whether the factor of traditional culture may, in the present study be of significance. It should be remembered that all the tests used in the I.B.P. studies have correlated positively and significantly with education. Education is, of course, an acculturation agent which has been demonstrated to exert a powerful

effect on the structure of mental abilities. Hudson et al[7] (1962), who were among the first to draw the attention to the influence of education on General Adaptability Battery scores, have argued that when " western " test procedures are followed, which includes the use of " western-style" tests such as the G.A.B., it cannot be expected that the variance observed will be caused to a marked degree by individual differences in intellectual potential alone, but rather by the ability or the capacity of an individual to adapt to a western industrialized environment. The acculturation process would appear to be uniform for all ethnic groups in South Africa, thus it is doubtful whether the test batteries used in the I.B.P. studies, and which will form the basis for our matched comparisons, will be sufficiently sensitive to shed any light on the differential patterning and structure of abilities of traditional rural-oriented Vendas and Pedis. Rather, all that may be demonstrated is that possibly, in the case of rural individuals, one tribe or the other might display a greater facility for becoming acculturated, which may or may not depend solely on traditional cultural factors facilitating or impeding such change.

It must be stressed then, that in the comparisons to follow, the Venda and the Pedi will not be contrasted so much in terms of their differing success in traditional rural adaptation which the present test-battery cannot fully demonstrate, but rather in terms of their potential for adaptation to an urban, industrialized way of life, or, in the case of samples that are already reasonably acculturated, in terms of their actual success in such adaptation.

1.3 Preliminary impressions of Venda-Pedi differences in cognitive performance.

The Venda investigation (Grant[8], (1969a) made use of a battery of 16 cognitive tests. Factor analysis of test intercorrelations revealed, however, that the author's claim that five conceptually distinct abilities should emerge as determined factors was a little ambitious and empirically unjustified. Consequently, in assembling

.../6

the Pedi battery (Kendall[9], 1971) a deliberate attempt was made to provide for the probable emergence of four well-determined abilities by selecting at least three tests to measure each factor. In order to achieve this objective, only 10 of the original 16 tests in the Venda battery were retained, while three new tests were added.

Tables 1A and 1B present the means and standard deviations for the 19 tests[1] that are common to both Venda and Pedi samples. The samples for which these statistics are quoted represent Venda and Pedi rural and urban groups, each divided into literate and illiterate subgroups. Table 2 summarises the significance and direction of the mean test-score differences observed between the two tribal samples in each experimental group. The significance levels were established by means of Student's t-test, or, in the event of heterogeneity of variance, by using the Welch test.

It is clear from Table 2 that the Venda and Pedi rural subgroups do not differ from one another significantly in respect of mean age and education. They already represent matched samples. Nevertheless, it can be seen that Pedi rural literates as a group have obtained mean test scores significantly higher than their Venda counterparts in the case of half the tests in the battery. Similarly, Pedi rural illiterates obtained mean test scores significantly superior to the Venda on three counts while Venda mean scores were observed to exceed those of the Pedi on two occasions. These mean differences are statistically significant at the 5% level of confidence (2-tailed test of significance).

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[1]For description of these tests, the reader is referred to Appendix A in this report.

.../7

RURAL

VARIABLE	LITERATE				ILLITERATE			
	Venda		Pedi		Venda		Pedi	
G.A.B.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
1. Sorting I	89,1	34,7	115,9	34,9	67,3	32,7	83,7	38,4
2. Sorting II	102,3	36,6	118,6	31,8	59,0	29,5	74,2	38,5
3. Cube	24,4	12,7	27,3	15,0	20,1	13,2	17,5	11,9
4. Tripod	34,8	14,7	38,9	14,8	24,6	15,3	31,8	14,6
5. Fret Repetition	8,8	1,7	9,2	1,5	6,5	3,0	6,8	3,1
6. Fret Continuation	7,7	2,6	7,4	3,2	5,2	3,6	4,0	3,5
7. Form Perception	20,4	5,0	20,5	5,0	18,7	5,2	17,1	6,5
8. Pattern Reproduction	22,7	9,7	26,7	8,7	16,3	8,2	16,3	8,7
9. Form Series	9,9	4,5	9,7	5,0	5,3	4,7	5,4	4,5
10. Symbol Series	6,3	3,5	6,1	3,8	3,3	2,9	2,8	2,3
11. Age	26,1	7,9	26,9	10,7	41,8	9,1	39,4	14,3
12. Education	4,3	1,7	4,4	2,2	0,0	0,0	0,0	0,0
	N = 105		N = 93		N = 94		N = 74	

TABLE 1A

Means and Standard Deviations for the RURAL Venda and Pedi samples compared: test scores, age and education

URBAN

VARIABLE	LITERATE				ILLITERATE			
	Venda		Pedi		Venda		Pedi	
G.A.B.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
1. Sorting I	118,8	34,1	129,9	27,8	100,8	36,9	107,3	38,2
2. Sorting II	120,1	27,5	129,2	28,8	86,7	33,3	88,9	28,3
3. Cube	31,2	15,4	33,7	16,1	25,8	13,0	25,2	13,9
4. Tripod	37,7	15,4	44,3	13,2	32,6	14,1	37,2	13,4
5. Fret Repetition	8,9	1,9	9,3	1,7	7,7	2,4	7,4	2,7
6. Fret Continuation	8,2	2,4	8,9	2,1	6,4	3,0	6,3	3,7
7. Form Perception	22,0	4,2	22,2	4,5	20,9	4,6	20,0	5,6
8. Pattern Reproduction	27,0	8,7	29,7	8,6	20,5	9,0	22,3	8,8
9. Form Series	11,0	4,5	12,2	4,8	7,3	4,6	8,5	5,6
10. Symbol Series	7,0	3,6	8,3	3,6	4,3	3,2	5,0	3,7
11. Age	38,8	10,2	30,1	8,4	45,4	7,1	38,0	10,3
12. Education	4,8	1,5	5,2	2,5	0,0	0,0	0,0	0,0
	N = 125		N = 109		N = 93		N = 116	

TABLE 1B

Means and Standard Deviations for the URBAN Venda and Pedi samples compared; test-scores, age and education.

TABLE 2

Significance and direction of mean test score differences for Venda and Pedi

Variable	Samples Compared: Venda x Pedi Rural Literates		Venda x Pedi Rural Illiterates		Venda x Pedi Urban Literates		Venda x Pedi Urbal Illiterates	
G.A.B.	t or v value	$\bar{X}$ difference in favour of:	t or v value	$\bar{X}$ difference in favour of:	t or v value	$\bar{X}$ difference in favour of:	t or v value	$\bar{X}$ difference in favour of:
1. Sorting I	5,41	Pedi	2,99	Pedi	2,74	Pedi	1,24	
2. Sorting II	3,32	Pedi	2,81	Pedi	2,47	Pedi	0,51	
3. Cube	1,46		1,32		1,21		0,32	
4. Tripod	1,95	Pedi	3,09	Pedi	3,49	Pedi	2,41	Pedi
5. Fret Repetition	1,75	Pedi	0,63		1,69	Pedi	0,84	
6. Fret Continuation	0,72		2,17	Venda	2,36	Pedi	0,22	
7. Form Perception	0,14		1,73	Venda	0,35		1,28	
8. Pattern Reproduction	3,04	Pedi	0,0		2,38	Pedi	1,45	
9. Form Series	0,30		0,14		1,97	Pedi	1,70	Pedi
10. Symbol Series	0,39		1,25		2,12	Pedi	1,44	
11. Age	0,59		1,26		7,15	Venda	6,13	Venda
12. Education	0,35		—		1,46		—	

t or v values underlined are significant at the 5% level of confidence.

In the case of comparisons involving the urban tribal samples it is to be noted that both the Venda literate and illiterate sub-groups are significantly older than the equivalent Pedi sub-groups, which invalidates comparison. Age has been observed to correlate negatively with a test score, thereby placing older groups of individuals at a disadvantage in the event of comparison.

There are few consistent differences between means for each test across the four sub-groups. The only striking examples of consistent superior performance on the part of the Pedi are to be found first of all in the case of the Tripod Assembly Test, and secondly the two Sorting Tests. All three tests belong to the General Adaptability Battery.

Could the above differences point, possibly, to significant differences in respect of certain isolated mental abilities ? Grant extracted five factors in his analysis of the Venda test-intercorrelations. These factors were equated with conceptually distinct abilities which he termed:

(i) perceptual analysis - the ability to analyse a perceptual configuration in terms of its component gestalten or elements, and to keep in mind or reproduce this configuration accurately.

(ii) perceptual speed - the ability to search sequentially through an array of perceptual material with the intention of isolating a given perceptual configuration borne in mind.

(iii) conceptual reasoning - the ability to discover or apply a rule relating concepts to one another.

(iv) space - the ability to perceive spatial patterns accurately in terms of part-whole relationships and to compare them with one another.

(v) . Perception of form relations - the ability to manipulate visual objects such that a reproduction of part of, or the

..../11

whole of, a new configuration which is merely suggested by an outline, is achieved.

For each of the Venda experimental groups (rural illiterate through to urban literate), separate factor analyses were performed. The extent of departure of the four factor matrices from the matrix common to all groups (i.e. the total Venda sample) was established by means of an intergroup factor analytic procedure.[1] The four sub-groups were compared in terms of the magnitude of factor intercorrelation which were assumed to reflect the extent to which individual abilities were correlated with one another. It was found that the number of such correlations exceeding a certain statistical criterion (see Grant[11], 1969a Table 34) increased as a function of acculturation. This observation was explained in terms of Ferguson's([12]1954, [13]1956) theory of positive transfer.

Contradictory findings were reported for the study of the Pedi structure of intellect. Kendall[14] (1971) found a consistent decrease in the number of such highly intercorrelated factors as a function of acculturation. Both authors were able to explain their findings in terms of Ferguson's hypothesis with Kendall[15] arguing that his findings do not thus necessarily refute those of Grant.[16] The Pedi Study was limited in scope to four and not five mental abilities, and such abilities it was felt were better determined factorially than was the case in the Venda study. This in itself might account for the discrepancy in findings, but also of importance is the fact that the inter-group procedures followed in each study differed somewhat, though not sufficiently to suggest that this was the cause of the contradictory findings.

Do the above findings point to meaningful tribal differences in the structure of intellect and in the relationship between acculturation and mental differentiation ? Quite possibly, in which case it would appear that the Pedi might have responded to a change

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[1] The rationale underlying this procedure is outlined in an appendixed note by M.W. Browne in Grant's[10] (1969a) report.

in culture at a far earlier stage in the acculturation process than have the Venda, but it is abundantly clear that the answers to the above problems reside in the execution of a carefully controlled comparative study of the structure of intellect of Vendas and Pedis, a study which would not only attempt to exercise control over the age and education of the samples, but which would use an identical test battery and which would employ identical statistical treatment of the data.

1.4 The comparability of the Venda and Pedi I.B.P. samples

It has already been indicated that the Venda and the Pedi rural samples are comparable in terms of mean age and education (See Tables 1 and 2). This is, however, not the case for the urban samples. Neither are urban and rural samples comparable within Pedi and Venda samples. There exists thus, a clear need to draw from among the I.B.P. subject pool, samples of Venda and Pedi matched in respect of age, education, and, as far as possible, urbanization. The manner of such matching will be described in the following section. For the time being it is necessary to point out that, unfortunately, the samples cannot be matched in such a way that the original sub-groups (i.e. rural illiterate through to urban literate) can be retained. Perusal of the frequency grid in Appendix B will indicate that concern for retaining such experimental divisions would result in the successful matching of but 19 subjects, which is clearly inadequate for statistical purposes. This number would be reduced even further if an attempt were made to control the variance in education between the literate groups. Of course, samples where N would be unequal across all groups would help to improve the situation, but such matching would not increase the samples to sizes required for statistical purposes.

The above problems are unfortunate in that analyses permitting interaction between education and urbanization may

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not be carried out. In consequence, two separate matched samples will be drawn. In the first, our prime concern will be the creation of samples matched in respect of mean age and education but varying in terms of tribe and urbanization. In the second, age will be held constant across all sub-groups while the interaction between education and tribal affiliation is studied.

Method

2.1 Matching the Venda and Pedi samples

2.1.1. Matched Sample "A" (controlling for age and education across 4 experimental groups: Venda Rural; Venda Urban; Pedi Rural and Pedi Urban). Matching was performed by creating a grid similar to the one tabularized in Appendix B. This grid was divided first of all into rural and urban; Pedi and Venda sections in order to from the 4 experimental groups to be matched. Within each experimental group, five class intervals were used for the age distribution (16-20 years; 21-30 ; 31-40 ; 41-50 and 51-55) while education was grouped according to 3 classes (zero years schooling; 1-4 years; 5-7 years). Each subject in the I.B.P.-pool was placed by number in the relevant cell in the grid, and for each combination to be matched (e.g. controlling for education across all experimental groups within a certain age class) the lowest frequency of subjects across all the cells concerned was noted, and was used as a base frequency for the selection of matched individuals within that age class from the other experimental groups. Subjects for these three experimental groups were matched with those in the base-cells by means of tables of random numbers.

This technique of matching resulted in the creation of 4 experimental groups each containing 86 subjects. In an effort to bring this total as close to 100 as possible, additional subjects were matched in such a way that subjects from one experimental group were selected from a cell of high frequency (e.g. Rural Venda,

..../14

TABLE 3

Variable	Statistic		Rural Venda	Urban Venda	Rural Pedi	Urban Pedi
AGE	Mean		35,42	35,42	34,99	35,12
	Standard Deviation		10,63	9,72	9,97	9,69
	Skewness		0,12	-0,08	-0,04	0,24
	Kurtosis		-1,91	-0,92	-0,94	-0,80
	Observed Range	Max	55,00	55,00	55,00	55,00
		Min	17,00	17,00	17,00	18,00
EDUCATION (N. years schooling)	Mean		2,39	2,60	2,48	2,54
	Standard Deviation		2,63	2,72	2,59	2,61
	Skewness		0,53	0,37	0,42	0,34
	Kurtosis		-1,29	-1,45	-1,41	-1,52
	Observed Range	Max	7,00	7,00	7,00	7,00
		Min	0,00	0,00	0,00	0,00

Matched Sample A: Descriptive Statistics for Age and Education (N:99)
(means, standard deviations, skewness, kurtosis and observed range)

aged 41-50 with no schooling) and were matched with individuals in the other three experimental groups not by drawing from the corresponding cells, but rather by " balancing-out" on either side of the cell to be matched. Thus, for example, for every two of the Rural Vendas, aged 41-50 with no schooling, one subject in each of the remaining experimental groups aged 31-50 with no education and one subject aged 51-55 with no education were selected at random, if subjects were still available from these cells. This additional matching was continued to a point where it was felt that even though mean age and education were still being held constant, the inclusion of further subjects would place homogeneity of variance in jeopardy. The result was the creation of four matched experimental groups each consisting of 99 individuals.

Table 3 presents the descriptive statistics pertaining to the age and education distributions for Matched Sample "A". Table 4 below summarizes the results of the test for homogeneity of variance for age and education across all four experimental groups.

TABLE 4

F-Ratios for Four Matched Samples Compared:

Matched Sample "A"

RV = Rural Venda, UV = Urban Venda, RP = Rural Pedi, UP = Urban Pedi

Variable	Comparison					
	RV x UV	RV x RP	RV x UP	UV x RP	UV x UP	RP x UP
Age	1,20	1,14	1,20	1,05	1,01	1,06
Education	1,07	1,03	1,02	1,10	1,09	1,02

All F-ratios not significant at 5% level of confidence

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In Table 5 are presented the results of the difference between means tests (t-tests) that were applied in order to determine possible significance in mean age and education across the four matched experimental groups.

TABLE 5

Comparison of Means - Age and Education

Matched Sample "A"

RV = Rural Venda , UV = Urban Venda , RP = Rural Pedi , UP = Urban Pedi

Comparison	Age				Education			
	$\bar{X}_1$	$\bar{X}_2$	Difference	t	$\bar{X}_1$	$\bar{X}_2$	Difference	t
RV x UV	35,42	35,42	-	-	2,39	2,60	0,21	0,55
RV x RP	35,42	34,99	0,43	0,29	2,39	2,48	0,09	0,24
RV x UP	35,42	35,12	0,30	0,21	2,39	2,54	0,15	0,40
UV x RP	35,42	34,99	0,43	0,31	2,60	2,48	0,12	0,32
UV x UP	35,42	35,12	0,30	0,22	2,60	2,54	0,06	0,16
RP x UP	34,99	35,12	0,13	0,09	2,48	2,54	0,06	0,16

All t-values not significant at 5% level of confidence

Tables 4 and 5, read together, indicate that not only do the means between the experimental groups in respect of the controlled variables age and education not differ significantly, but that homogeneity of variance may also be assumed. It may be concluded therefore that successful matching of the four experimental groups in terms of age and education has been accomplished.

2.1.2. Matched Sample "B"(controlling for age across 4

..../17

TABLE 6

Matched Sample B: Descriptive Statistics for Age and Education (N=76)

(means, standard deviations, skewness, kurtosis and observed range)

Variable	Statistic		Illiterate Venda	Literate Venda	Illiterate Pedi	Literate Pedi
Age	Mean		36,87	36,60	36,71	36,64
	Standard Deviation		8,18	8,38	8,34	8,73
	Skewness		0,11	0,01	-0,12	-0,10
	Kurtosis		-0,21	-0,41	-0,29	-0,63
	Observed Range	Max.	55,00	55,00	55,00	53,00
		Min.	20,00	20,00	18,00	18,00
Education (N. years schooling)	Mean		-	4,68	-	4,53
	Standard Deviation		-	1,99	-	2,25
	Skewness		-	0,13	-	0,03
	Kurtosis		-	- 0,82	-	-1,09
	Observed Range	Max.	0,00	8,00	0,00	8,00
		Min.	0,00	1,00	0,00	1,00

experimental groups : Venda Illiterate; Venda Literate; Pedi Illiterate; Pedi Literate). Analysis of Venda-Pedi differences in cognitive performance by means of Matched Sample "A" alone does not permit a study of the interaction of tribal affiliation and education. Matching the two ethnic groups according to different criteria was performed by using the grid in Appendix B. This grid was divided first of all into Venda and Pedi, and then into Rural and Urban sections. For purposes of matching, however, the Rural and Urban sections were collapsed into one[1]. The education range for the literate experimental groups was divided into 4 classes at 2 year intervals. Illiteracy, of course, constituted its own class. Across the four experimental groups, age was divided into 8 classes at 5 year intervals.

Subjects were again matched by means of tables of random numbers, using the lowest-cell frequency principle. This technique resulted in the matching of 63 individuals in each of the four experimental groups, to which were added a further 13 individuals after " balancing-out " in the manner described in the matching of Sample "A". Thus each experimental group contains 76 subjects.

Table 6 presents the descriptive statistics pertaining to age and, in the case of the literate samples, education, for Matched Sample "B". Table 7 summarizes the results of the test for homogeneity of variance across all four groups for age and education.

TABLE 7

F-ratios for Four Matched Samples Compared:

Matched Sample "B"

IV = Illiterate Venda, IP = Illiterate Pedi, LV = Literate Venda, LP = Literate Pedi

Variable	Comparison					
	IV x IP	IV x LV	IV x LP	IP x LV	IP x LP	LV x LP
Age	1,04	1,05	1,14	1,01	1,10	1,09
Education	-	-	-	-	-	1,28

All F-ratios not significant at 5% level of confidence.

[1] It was not possible to attempt control over urbanization in the present case of matching. Consequently, some groups are over-represented by rural subjects.

In Table 8 are presented the results of the difference between means tests (t-tests) applied to determine possible significance of differences in mean age and, in the case of the literate samples compared, education across the four experimental groups.

TABLE 8

Comparison of Means - Age and Education

Matched Sample "B"

IV = Illiterate Venda, IP = Illiterate Pedi, LV = Literate Venda, LP = Literate Pedi

Comparison	Age				Education			
	$\bar{X}_1$	$\bar{X}_2$	Difference	t	$\bar{X}_1$	$\bar{X}_2$	Difference	t
IV x IP	36,87	36,71	0,06	0,12	0,0	0,0	-	-
IV x LV	36,87	36,60	0,27	0,20	0,0	4,68	-	-
IV x LP	36,87	36,64	0,23	0,17	0,0	4,53	-	-
IP x LV	36,71	36,60	0,11	0,08	0,0	4,68	-	-
IP x LP	36,71	36,64	0,07	0,05	0,0	4,53	-	-
LV x LP	36,60	36,64	0,04	0,03	4,68	4,53	0,15	0,44

All t-values not significant at 5% level of confidence.

Direct control over the proportion of rural to urban subjects in each of the four experimental groups was not exercised. The proportions are as follows:

(i) Illiterate Venda: 42 rural to 34 urban subjects.

(ii) Illiterate Pedi: 39 rural to 37 urban subjects.

(iii) Literate Venda: 34 rural to 42 urban subjects.

(iv) Literate Pedi: 47 rural to 29 urban subjects.

A chi-square test nevertheless indicated a non-significant

.../19

difference between these frequencies at the 5% level of significance ($\chi^2 = 4,70$; d.f. = 3)

Again it may be concluded that successful matching of the four experimental groups in terms of age and, in the case of the literate samples, education, has been accomplished. Tables 7 and 8 indicate that there are no significant mean age and education differences, neither may homogeneity of variance be questioned. In addition, it would appear that reasonable matching in terms of the urban-rural dichotomy has been achieved.[1]

2.2 Statistical analysis of differences in mean cognitive test performances

2.2.1 Matched Sample "A" (tribe x urbanization interaction)

Tables 9 to 12 summarize the descriptive statistics for each of the 10 cognitive tests in the battery common to both Venda and Pedi studies. Included in these tables are the means, standard deviations, coefficients of skewness and kurtosis, and observed variable ranges. The reliability coefficient, for the 10 tests, based on measures of internal consistency, are also reflected in these tables. Sichel's modification of the Kuder-Richardson formula 3. (Sichel,[18] 1950) was used to calculate the reliabilities of the

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[1] "Urban" and "rural" are here used in the sense of urban vs rural domicile on the part of the subject. It does not refer to attitudinal urbanization as opposed to rural traditionalism. Administration of the Urban-Rural Scale (Grant,[17] 1969b) to the Venda samples demonstrated that at best, the urban-domiciled subjects were to be regarded as only partly acculturated. The schedule was not administered to the Pedi rural-domiciled subjects, but the findings as regard the urban sample suggest that this sample are attitudinally less urban than the Venda. Matching in respect of psychosocial urbanization might not have been achieved in consequence.

..../20

TABLE 9

Rural Venda Matched (N:99)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	SD	SK	Kt	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	80,16	34,10	0,28	— 0,35	159,00	2,00	0,83
2. Sorting II	78,10	39,89	0,39	— 0,97	156,00	9,00	0,93
3. Cubes	24,10	14,04	0,55	—0,48	60,00	1,00	0,84
4. Tripod	28,60	16,33	0,47	—0,62	63,00	0,0	0,88
5. Form Perception	19,34	5,24	— 0,79	0,17	27,00	3,00	0,66
6. Pattern Reproduction	19,97	9,24	0,40	— 0,95	39,00	3,00	0,82
7. F.S.T.	7,35	4,94	0,24	— 0,83	18,00	0,0	0,89
8. Symbol Series	4,42	3,52	0,70	— 0,61	12,00	0,0	0,88
9. Fret Repetition	7,65	2,99	— 1,48	1,11	10,00	0,0	0,92
10. Fret Continuation	6,79	3,31	— 0,80	— 0,85	10,00	0,0	0,92
11. Age	35,42	10,63	0,12	— 1,08	55,00	17,00	
12. Education	2,39	2,63	0,53	— 1,29	7,00	0,0	

TABLE 10

Rural Pedi Matched (N:99)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	SD	SK	Kt	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	102,34	38,37	- 0,41	- 0,72	160,00	15,00	0,81
2. Sorting II	98,87	40,21	- 0,31	- 0,98	160,00	12,00	0,98
3. Cubes	23,70	13,94	0,33	- 0,75	54,00	0,0	0,80
4. Tripod	36,86	14,58	- 0,21	- 0,56	63,00	2,00	0,78
5. Form Perception	20,15	5,41	- 0,89	0,66	27,00	2,00	0,69
6. Pattern Reproduction	20,91	9,68	0,21	- 0,97	39,00	3,00	0,82
7. F.S.T.	7,71	5,24	0,15	- 1,18	18,00	0,0	0,91
8. Symbol Series	4,50	3,58	0,63	- 0,82	12,00	0,0	0,94
9. Fret Repetition	8,16	2,77	- 1,69	1,77	10,00	0,0	0,94
10. Fret Continuation	5,70	3,75	- 0,21	- 1,58	10,00	0,0	0,94
11. Age	34,99	9,97	- 0,04	- 0,94	55,00	17,00	
12. Education	2,48	2,59	0,42	- 1,41	7,00	0,0	

TABLE 11

Urban Venda Matched (N:99)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis
Observed Ranges and Reliabilities

Variable	$\bar{X}$	SD	SK	Kt	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	118,93	33,52	- 0,67	- 0,47	160,00	31,00	0,76
2. Sorting II	110,22	35,74	- 0,34	- 1,06	160,00	27,00	0,88
3. Cubes	31,30	15,44	- 0,01	- 0,87	60,00	0,00	0,84
4. Tripod	38,73	14,77	- 0,24	- 0,52	63,00	0,00	0,80
5. Form Perception	22,00	4,34	— 1,12	1,29	27,00	6,00	0,57
6. Pattern Reproduction	25,79	9,21	- 0,21	- 1,06	39,00	6,00	0,74
7. F.S.T.	9,39	5,12	0,10	- 1,22	18,00	1,00	0,90
8. Symbol Series	6,68	3,86	- 0,25	- 1,19	12,00	0,0	0,90
9. Fret Repetition	8,35	2,43	- 1,80	2,50	10,00	1,00	0,91
10. Fret Continuation	7,67	2,74	- 1,39	0,91	10,00	0,0	0,89
11. Age	35,42	9,72	- 0,08	- 0,92	7,00	0,0	
12. Education	2,60	2,72	0,37	- 1,45	27,00	6,00	

TABLE 12

Urban Pedi Matched (N:99)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	SD	SK	Kt	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	115,19	38,35	- 1,04	0,73	160,00	0,0	0,87
2. Sorting II	106,86	39,72	- 0,34	- 1,19	160,00	29,00	0,93
3. Cubes	28,71	14,81	0,39	- 0,44	60,00	2,00	0,81
4. Tripod	40,59	12,98	- 0,12	- 0,19	63,00	0,0	0,83
5. Form Perception	21,59	4,71	- 1,16	1,32	27,00	4,00	0,66
6. Pattern Reproduction	25,42	9,25	- 0,31	- 0,79	39,00	6,00	0,79
7. F.S.T.	10,53	5,38	0,20	- 1,29	18,00	0,0	0,92
8. Symbol Series	6,48	4,02	0,0	- 1,48	12,00	0,0	0,91
9. Fret Repetition	8,31	2,38	- 1,60	1,52	10,00	1,00	0,89
10. Fret Continuation	7,50	3,24	- 1,27	0,20	10,00	0,0	0,94
11. Age	35,12	9,70	0,24	- 0,80	55,00	18,00	
12. Education	2,54	2,62	0,34	- 1,52	7,00	0,0	

speeded tests (G.A.B. tests) Kuder-Richardson fromula 21 with Tucker's correction was used in the case of the two Fret tests and the two Series tests, while Ferguson's extension of Kuder-Richardson formula 20 was used to calculate the reliabilities of Form Perception and Pattern Reproduction.

The F-ratios for the four groups compared are shown in Table 13. Difference between means tests were then carried out by applying either t-tests or Welch tests. The comparisons of the means of each group on each test with the other groups, together with indications of the significance of the differences observed are shown in Tables 14 and 15. These comparisons involve:

(i) Within tribe analyses (Rural Venda x Urban Venda; Rural Pedi x Urban Pedi)

(ii) Between tribe analyses (Rural Venda x Rural Pedi; Urban Venda x Urban Pedi)

It should be noted that the t or v values which have been underlined are significant at the 5% level of confidence.

2.2.2. Matched Sample "B" (tribe x education interaction)

The means, standard deviations, coefficients of skewness and kurtosis and observed ranges for the four experimental groups in matched sample "B" are reflected in Tables 16 to 19. Also reported in these tables are the reliability coefficients for the 10 cognitive tests.

The F-ratios for the four groups compared appear in Table 20, while difference between means tests are summarized in Tables 21 and 22. Again, these comparisons involve both within and between tribe analyses.

2.3 Statistical analysis of differences in the structure of mental abilities.

Considerable problems will be encountered in the analysis of the structure of mental abilities for the two tribal groups. As already

..../26

TABLE 13

F-ratios for four matched groups compared : Matched Sample "A"

RV = Rural Venda, RP = Rural Pedi, UV = Urban Venda, UP = Urban Pedi

Variable	RV x RP	RV x UV	RP x UP	UV x UP
1. Sorting I	1,27	1,03	1,00	1,31
2. Sorting II	1,02	1,25	1,02	1,24
3. Cubes	1,01	1,21	1,13	1,09
4. Tripod	1,25	1,22	1,26	1,29
5. Form Perception	1,07	1,46	1,32	1,18
6. Pattern Reproduction	1,05	1,16	1,10	1,01
7. F.S.T.	1,13	1,07	1,05	1,10
8. Symbol Series	1,03	1,20	1,26	1,08
9. Fret Repetition	1,17	1,51	1,35	1,04
10. Fret Continuation	1,28	1,46	1,34	1,40
11. Age	1,14	1,20	1,06	1,01
12. Education	1,03	1,07	1,02	1,09

All F-ratios underlined denote variance differences significant at 5% level of confidence

TABLE 14

Comparison of Means: Matched Sample "A"

Within Tribe Analysis

A : Rural Venda x Urban Venda

Variable	Rural Venda $\bar{X}$	Urban Venda $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	80,16	118,93	Urban	8,07
2. Sorting II	78,10	110,22	Urban	5,97
3. Cube Construction	24,10	31,30	Urban	3,43
4. Tripod Assembly	28,60	38,73	Urban	4,58
5. Form Perception	19,34	22,00	Urban	v= 3,89
6. Pattern Reproduction	19,97	25,79	Urban	4,28
7. Form Series	7,38	9,39	Urban	2,85
8. Symbol Series	4,42	6,68	Urban	4,30
9. Fret Repetition	7,65	8,35	Urban	v=1,81
10. Fret Continuation	6,79	7,67	Urban	v=2,04

B: Rural Pedi x Urban Pedi

Variable	Rural Pedi $\bar{X}$	Urban Pedi $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	102,34	115,19	Urban	2,36
2. Sorting II	98,87	106,86		1,41
3. Cube Construction	23,70	28,71	Urban	2,45
4. Tripod Assembly	36,86	40,59	Urban	1,90
5. Form Perception	20,15	21,59	Urban	2,00
6. Pattern Reproduction	20,91	25,42	Urban	3,35
7. Form Series	7,71	10,53	Urban	3,75
8. Symbol Series	4,50	6,48	Urban	3,66
9. Fret Repetition	8,16	8,31		0,41
10. Fret Continuation	5,70	7,50	Urban	3,61

d.f. = 196 $v = 98$ $v_2 = 98$

$t_{,05} = 1,64$ v_1 $v_{,05} = 1,64$

.../28

TABLE 15

Comparison of means: Matched Sample "A"

Between Tribe Analysis

A: Rural Venda x Rural Pedi

Variable	Rural Venda $\bar{X}$	Rural Pedi $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	80,16	102,34	Pedi	4,30
2. Sorting II	78,10	98,87	Pedi	3,65
3. Cube Construction	24,10	23,70		0,20
4. Tripod Assembly	28,60	36,86	Pedi	3,75
5. Form Perception	19,34	20,15		1,07
6. Pattern Reproduction	19,97	20,91		0,67
7. Form Series	7,35	7,71		0,50
8. Symbol Series	4,42	4,50		0,16
9. Fret Repetition	7,65	8,16		1,24
10. Fret Continuation	6,79	5,70	Venda	2,17

B: Urban Venda x Urban Pedi

Variable	Urban Venda $\bar{X}$	Urban Pedi $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	118,93	115,19		0,73
2. Sorting II	110,22	106,86		0,63
3. Cube Construction	31,30	28,71		1,20
4. Tripod Assembly	38,73	40,59		0,94
5. Form Perception	22,00	21,59		0,64
6. Pattern Reproduction	25,79	25,42		0,28
7. Form Series	9,39	10,53		1,53
8. Symbol Series	6,68	6,48		0,36
9. Fret Repetition	8,35	8,31		0,12
10. Fret Continuation	7,67	7,50		v=0,40

d.f. = 196 v_1 = 98 v_2 = 98

t,05 = 1,64 v,05= 1,64

.../29

TABLE 16

Illiterate Venda Matched (N: 76)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	S.D.	Sk.	Kt	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	93,45	40,49	0,01	- 0,78	160,00	2,00	0,80
2. Sorting II	79,42	38,72	0,33	- 0,62	157,00	9,00	0,94
3. Cube Construction	24,25	14,63	0,38	- 0,63	60,00	0,00	0,84
4. Tripod Assembly	33,91	16,13	0,03	- 0,91	63,00	0,00	0,85
5. Form Perception	20,32	5,49	-0,94	0,10	27,00	5,00	0,79
6. Pattern Reproduction	19,04	9,54	0,66	- 0,57	39,00	4,00	0,77
7. Form Series	6,22	4,77	0,60	- 0,33	18,00	0,00	0,89
8. Symbol Series	4,20	3,15	0,46	- 0,64	12,00	0,00	0,84
9. Fret Repetition	6,93	3,15	-0,87	- 0,50	10,00	0,00	0,91
10. Fret Continuation	6,04	3,47	-0,46	- 1,36	10,00	0,00	0,92
11. Age	36,87	8,18	0,11	- 0,21	55,00	20,00	
12. Education	0,00	-	-	-	-	-	

TABLE 17

Illiterate Pedi Matched (N:76)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	S.D.	Sk.	Kt.	Observed Range		Reliability
					Max.	Min.	
1. Sorting 1	97,57	40,44	- 0,42	- 0,84	160,00	0,00	0,77
2. Sorting II	87,72	38,34	0,11	- 1,16	158,00	12,00	0,92
3. Cube Construction	23,83	14,23	0,19	- 1,08	54,00	2,00	0,82
4. Tripod Assembly	35,91	14,01	-0,36	- 0,03	63,00	0,00	0,77
5. Form Perception	19,64	6,08	- 1,03	0,42	27,00	2,00	0,76
6. Pattern Reproduction	21,88	9,18	- 0,08	- 0,96	39,00	3,00	0,77
7. Form Series	7,96	5,49	0,36	- 1,00	18,00	0,00	0,92
8. Symbol Series	4,22	3,37	1,00	- 0,16	12,00	0,00	0,86
9. Fret Repetition	7,42	3,02	- 1,08	- 0,23	10,00	1,00	0,92
10. Fret Continuation	5,75	3,81	- 0,37	- 1,51	10,00	0,00	0,94
11. Age	36,71	8,34	- 0,12	- 0,29	55,00	18,00	
12. Education	0,00	-	-	-	-	-	

TABLE 18

Literate Venda Matched (N:76)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	S.D.	Sk	Kt.	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	106,67	40,89	- 0,55	- 0,78	160,00	10,00	0,88
2. Sorting II	106,41	34,20	- 0,24	- 1,02	158,00	36,00	0,84
3. Cube Construction	27,79	13,96	0,48	- 0,73	60,00	5,00	0,80
4. Tripod Assembly	36,16	14,36	-0,02	- 0,58	63,00	2,00	0,82
5. Form Perception	21,97	4,98	- 1,37	2,22	27,00	3,00	0,70
6. Pattern Reproduction	24,84	9,71	- 0,21	- 1,06	39,00	5,00	0,78
7. Form Series	10,39	4,89	- 0,19	- 1,04	18,00	0,00	0,89
8. Symbol Series	6,43	3,78	- 0,09	- 1,32	12,00	0,00	0,89
9. Fret Repetition	8,85	1,56	- 1,69	2,69	10,00	3,00	0,78
10. Fret Continuation	8,34	2,11	- 1,69	2,46	10,00	1,00	0,84
11. Age	36,60	8,38	0,01	- 0,41	55,00	20,00	
12. Education	4,68	1,99	0,13	- 0,82	8,00	1,00	

TABLE 19

Literate Pedi Matched (N:76)

Means, Standard Deviations, Coefficients of Skewness and Kurtosis, Observed Ranges and Reliabilities

Variable	$\bar{X}$	S.D.	Sk.	Kt.	Observed Range		Reliability
					Max.	Min.	
1. Sorting I	117,29	33,18	-0,65	- 0,44	160,00	30,00	0,79
2. Sorting II	116,51	35,99	- 0,73	- 0,42	160,00	25,00	0,92
3. Cube Construction	28,33	14,72	0,10	- 0,62	60,00	0,00	0,83
4. Tripod Assembly	39,26	14,48	- 0,24	- 0,61	63,00	2,00	0,81
5. Form Perception	21,22	4,93	- 0,90	0,26	27,00	7,00	0,64
6. Pattern Reproduction	25,21	9,31	- 0,19	- 0,83	39,00	6,00	0,79
7. Form Series	9,97	5,22	- 0,25	- 1,04	18,00	0,00	0,91
8. Symbol Series	6,51	3,77	- 0,01	- 1,27	12,00	0,00	0,89
9. Fret Repetition	8,78	2,38	- 2,57	6,09	10,00	0,00	0,96
10. Fret Continuation	7,37	3,31	- 1,12	- 0,20	10,00	0,00	0,94
11. Age	36,64	8,73	- 0,10	- 0,63	53,00	18,00	
12. Education	4,53	2,25	0,03	- 1,09	8,00	1,00	

TABLE 20

F-ratios for four matched groups compared: Matched Sample "B"

IV = Illiterate Venda, IP = Illiterate Pedi, LV = Literate Venda, LP = Literate Pedi

Variable	IV x IP	IV x LV	IP x LP	LV x LP
1. Sorting I	1,00	1,02	1,49	1,52
2. Sorting II	1,02	1,28	1,13	1,11
3. Cubes	1,06	1,10	1,07	1,11
4. Tripod	1,33	1,26	1,07	1,02
5. Form Perception	1,23	1,22	1,52	1,02
6. Pattern Reproduction	1,08	1,04	1,03	1,09
7. F.S.T.	1,32	1,05	1,11	1,14
8. Symbol Series	1,14	1,44	1,25	1,01
9. Fret Repetition	1,09	4,08	1,61	2,33
10. Fret Continuation	1,21	2,70	1,32	2,46
11. Age	1,04	1,05	1,10	1,09
12. Education	-	-	-	1,28

All F-ratios underlined denote variance differences significant at 5% level of confidence

TABLE 21

Comparison of Means: Matched Sample "B"
Within Tribe Analysis

A: Illiterate Venda x Literate Venda

Variable	Illiterate Venda $\bar{X}$	Literate Venda $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	93,45	106,67	Literate	2,00
2. Sorting II	79,42	106.41	Literate	4,55
3. Cube Construction	24,25	27,79		1,53
4. Tripod Assembly	33,91	36,16		0,91
5. Form Perception	20,32	21,97	Literate	1,94
6. Pattern Reproduction	19,04	24,84	Literate	3,71
7. Form Series	6,22	10,39	Literate	5,32
8. Symbol Series	4,20	6,43	Literate	3,95
9. Fret Repetition	6,93	8,85	Literate	v= 4,76
10. Fret Continuation	6,04	8,34	Literate	v= 4,94

B: Illiterate Pedi x Literate Pedi

Variable	Illiterate Venda $\bar{X}$	Literate Venda $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	97,57	117,29	Literate	v= 3,29
2. Sorting II	87,72	116,51	Literate	4,77
3. Cube Construction	23,83	28,33	Literate	1,92
4. Tripod Assembly	35,91	39,26		1,45
5. Form Perception	19,64	21,22	Literate	v= 1,76
6. Pattern Reproduction	21,88	25,22	Literate	2,22
7. Form Series	7,96	9,97	Literate	2,31
8. Symbol Series	4,22	6.51	Literate	3,95
9. Fret Repetition	7,42	8,78	Literate	v= 3,08
10. Fret Continuation	5,75	7,37	Literate	2,80

d.f. = 196 v = 98 v_a = 98
t,05 = 1,64 v,05 = 1,64

TABLE 22

Comparison of Means : Matched Sample "B"
Between Tribe Analysis

A: Illiterate Venda x Illiterate Pedi

Variable	Illiterate Venda $\bar{X}$	Illiterate Pedi $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	93,45	97,57		0,63
2. Sorting II	79,42	87,72		1,33
3. Cube Construction	24,25	23,83		0,18
4. Tripod Assembly	33,91	35,91		0,82
5. Form Perception	20,32	19,64		0,72
6. Pattern Reproduction	19,04	21,88	Pedi	1,87
7. Form Series	6,22	7,96	Pedi	2,09
8. Symbol Series	4,20	4,22		0,04
9. Fret Repetition	6,93	7,42		0,98
10. Fret Continuation	6,04	5,75		0,49

B: Literate Venda x Literate Pedi

Variable	Literate Venda $\bar{X}$	Literate Pedi $\bar{X}$	Difference Favours:	t or v value
1. Sorting I	106,67	117,29	Pedi	v=1,76
2. Sorting II	106,41	116,51	Pedi	1,77
3. Cube Construction	27,79	28,33		0,23
4. Tripod Assembly	36,16	39,26		1,33
5. Form Perception	21,97	21,22		0,93
6. Pattern Reproduction	24,84	25,21		0,24
7. Form Series	10,39	9,97		0,51
8. Symbol Series	6,43	6,51		0,13
9. Fret Repetition	8,85	8,78		v=0,21
10. Fret Continuation	8,34	7,37	Venda	v=2,15

d.f. = 196 v_1 = 98 v_2 = 98
t,05 = 1,64 v,05 = 1,64

indicated, both Venda and Pedi test batteries were assembled with a view to measuring specific numbers of abilities. In order to determine such abilities in factorial form, both studies recognized the need to reference each potential factor by at least 3 tests. Analyses of both the Venda and Pedi rotated factor matrices revealed that in neither investigation was factorial determination achieved for all factors. In the Venda investigation, two of the factors, labelled perception of form relations and perceptual analysis, emerged as doublets with the remaining three factors appearing in determined form that was all the same not too convincing. (See Grant[19], 1969a, Table 33). In the case of the Pedi study, two of the four factors emerged in well-determined form (labelled perceptual speed and conceptual reasoning) while perceptual analysis and the spatial factor emerged poorly determined. (See Kendall[20], 1971, Table 43).

Thus, in the case of the test battery shared in common by both investigations, it can hardly be expected that four determined abilities will be represented in the intercorrelations between the 10 tests. Table 23 presents the expected relationship of the 10 test variables to each of the four factors postulated in the I.B.P. Studies, in order to demonstrate this point.

...../37

TABLE 23

MATRIX OF EXPECTED FACTOR LOADINGS

FOUR-FACTOR STRUCTURE

Test \ Factor	Perceptual Speed	Space	Conceptual Reasoning	Perceptual Analysis
1. Sorting I	9	0	0	0
2. Sorting II	9	0	0	0
3. Cube Construction	0	9	0	0
4. Tripod Assembly	0	9	0	0
5. Form Perception	0	9	0	0
6. Pattern Reproduction	0	0	9	0
7. Form Series	0	0	9	0
8. Symbol Series	0	0	9	0
9. Fret Repetition	0	0	0	9
10. Fret Continuation	0	0	0	9

The value 0 signifies the expectancy that the loading on a given factor will be as close to zero as possible, whereas the value 9 denotes an unspecified relationship between the test and the factor. It is clear that even if a good fit of the data to the target were to be achieved factorial determination would be possible in the case of two of the factors, but the remaining two factors would emerge at best as doublets. It might be concluded that short of the postulation of a 1-factor model, any factor analysis that would be carried out on the matched sample test battery intercorrelations would yield equivocal results. For this reason, greater significance will be attached to the interpretation of sample differences in respect of test-intercorrelations and covariance matrices than in respect of factor matrices.

...../38

2.3.1. Matched Sample "A" (tribe by urbanization)

Each test in the matched study battery was correlated with every other test by means of Pearson's product-moment technique, for all four experimental groups. The lower half of the intercorrelation matrices appears in Tables 24-27. In addition, in the top right-hand corner of each table, the average intercorrelation for each experimental group has been noted in the inset.

A good indication of the possibility of significant differences in the structure of intellect between experimental groups is given by a comparison of the covariance matrices for each group. Accordingly, covariance matrices were calculated for each group, and were rescaled for purposes of standard comparison. A number of likelihood ratio tests (Box-Wilks test) were then carried out to test the equality of the rescaled covariance matrices. The Lambda (λ) statistic for the various comparisons performed was as follows:

(i) Within-tribe comparisons

Rural Venda x Urban Venda $\lambda = 60,71$ $df = 55$ $p > 0,05$

Rural Pedi x Urban Pedi $\lambda = 70,80$ $df = 55$ $p > 0,05$

(ii) Between-tribe comparisons

Rural Venda x Rural Pedi $\lambda = 73,61$ $df = 55$ $p < 0,05 > 0,01$

Urban Venda x Urban Pedi $\lambda = 71,53$ $df = 55$ $p > 0,05$

It can be concluded from the above that in respect of within tribe urban-rural comparisons the differences observed are not statistically significant. In the case of between tribe comparisons the Venda and Pedi rural samples differ significantly in terms of covariance matrices at the 5% level of confidence but not at the 1% level.

2.3.2. Matched Sample "B" (tribe by education)

The lower half of the test intercorrelation matrices for the four experimental groups in sample "B" appears in Tables 28-31 . Covariance matrices were calculated for each group and Box-Wilks tests were carried out to test the equality of the matrices when compared.

..../39

TABLE 24

Test Intercorrelation matrix for Rural Venda Sample

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,57	-								
3. Cube Construction	0,46	0,39	-							
4. Tripod Assembly	0,51	0,34	0,56	-						
5. Form Perception	0,38	0,27	0,41	0,44	-					
6. Pattern Reproduction	0,56	0,63	0,60	0,60	0,40	-				
7. Form Series	0,42	0,61	0,50	0,52	0,35	0,68	-			
8. Symbol Series	0,36	0,59	0,52	0,44	0,28	0,65	0,76	-		
9. Fret Repetition	0,51	0,51	0,46	0,42	0,48	0,52	0,59	0,44	-	
10. Fret Continuation	0,59	0,58	0,54	0,48	0,36	0,64	0,62	0,51	0,76	-

$N = 99$

$\bar{r}_x = 0,51$

All coefficients significant at the 5% level of confidence

TABLE 25

Test Intercorrelation Matrix for Rural Pedi Sample

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,61	-								
3. Cube Construction	0,40	0,34	-							
4. Tripod Assembly	0,55	0,42	0,49	-						
5. Form Perception	0,44	0,50	0,42	0,30	-					
6. Pattern Reproduction	0,36	0,51	0,61	0,43	0,42	-				
7. Form Series	0,39	0,46	0,60	0,39	0,49	0,67	-			
8. Symbol Series	0,42	0,50	0,47	0,37	0,41	0,64	0,67	-		
9. Fret Repetition	0,24	0,46	0,39	0,26	0,41	0,43	0,34	0,43	-	
10. Fret Continuation	0,31	0,44	0,43	0,30	0,41	0,49	0,41	0,44	0,63	-

N = 99

r_x = 0,45

All coefficients significant at the 5% level of confidence

TABLE 26

Test Intercorrelation Matrix for Urban Venda Sample

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,45	-								
3. Cube Construction	0,36	0,37	-							
4. Tripod Assembly	0,38	0,25	0,66	-						
5. Form Perception	0,36	0,22	0,33	0,44	-					
6. Pattern Reproduction	0,49	0,50	0,61	0,56	0,42	-				
7. Form Series	0,27	0,40	0,41	0,41	0,26	0,51	-			
8. Symbol Series	0,49	0,50	0,52	0,44	0,28	0,59	0,71	-		
9. Fret Repetition	0,36	0,41	0,48	0,38	0,40	0,59	0,34	0,45	-	
10. Fret Continuation	0,31	0,44	0,47	0,37	0,38	0,61	0,40	0,52	0,62	-

$N = 99$

$r_{\bar{x}} = 0,44$

All coefficients significant at the 5% level of confidence.

TABLE 27

Test Intercorrelation Matrix for Urban Pedi Sample

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,60	-								
3. Cube Construction	0,43	0,33	-							
4. Tripod Assembly	0,58	0,37	0,51	-						
5. Form Perception	0,41	0,31	0,48	0,39	-					
6. Pattern Reproduction	0,46	0,51	0,55	0,47	0,49	-				
7. Form Series	0,43	0,46	0,41	0,28	0,40	0,60	-			
8. Symbol Series	0,46	0,50	0,42	0,33	0,46	0,66	0,66	-		
9. Fret Repetition	0,44	0,57	0,48	0,34	0,42	0,54	0,48	0,53	-	
10. Fret Continuation	0,40	0,56	0,51	0,36	0,44	0,57	0,48	0,53	0,87	-

N = 99

$\bar{r}_x = 0,48$

All intercorrelations significant at the 5% level of confidence

TABLE 28

Test Intercorrelation Matrix for Illiterate Venda

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,55	-								
3. Cube Construction	0,57	0,46	-							
4. Tripod Assembly	0,56	0,39	0,63	-						
5. Form Perception	0,56	0,30	0,30	0,51	-					
6. Pattern Reproduction	0,56	0,45	0,63	0,64	0,41	-				
7. Form Series	0,54	0,50	0,47	0,62	0,37	0,61	-			
8. Symbol Series	0,51	0,49	0,42	0,44	0,26	0,47	0,74	-		
9. Fret Repetition	0,48	0,48	0,57	0,52	0,54	0,57	0,45	0,38		
10. Fret Continuation	0,51	0,47	0,55	0,57	0,41	0,64	0,53	0,44	0,75	-

$N = 76$

$\bar{r}_x = 0,51$

All intercorrelations significant at the 5% level of confidence

TABLE 29

Test Intercorrelation Matrix for Illiterate Pedi

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,59	-								
3. Cube Construction	0,47	0,44	-							
4. Tripod Assembly	0,54	0,45	0,60	-						
5. Form Perception	0,43	0,41	0,44	0,40	-					
6. Pattern Reproduction	0,51	0,64	0,65	0,56	0,45	-				
7. Form Series	0,48	0,56	0,57	0,46	0,47	0,68	-			
8. Symbol Series	0,39	0,44	0,59	0,38	0,38	0,58	0,71	-		
9. Fret Repetition	0,35	0,55	0,59	0,47	0,53	0,56	0,54	0,48	-	
10. Fret Continuation	0,33	0,44	0,61	0,48	0,57	0,65	0,60	0,52	0,77	-

$N = 76$

$r_s = 0,52$

All intercorrelations significant at the 5% level of confidence

TABLE 30

Test Intercorrelation Matrix for Literate Venda

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,55	-						N = 76		
3. Cube Construction	0,60	0,32	-					$r_x^- = 0,46$		
4. Tripod Assembly	0,58	0,25	0,64	-						
5. Form Perception	0,53	0,33	0,42	0,43	-					
6. Pattern Reproduction	0,66	0,59	0,68	0,55	0,49	-				
7. Form Series	0,48	0,55	0,47	0,35	0,42	0,62	-			
8. Symbol Series	0,54	0,52	0,55	0,45	0,33	0,74	0,69	-		
9. Fret Repetition	0,32	0,20*	0,40	0,23	0,25	0,38	0,21*	0,33	-	
10. Fret Continuation	0,47	0,36	0,41	0,33	0,43	0,52	0,37	0,48	0,52	-

* Not significant at the 5% level of confidence.

TABLE 31

Test Intercorrelation Matrix for Literate Pedi

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,59	-								
3. Cube Construction	0,43	0,30	-							
4. Tripod Assembly	0,47	0,32	0,56	-						
5. Form Perception	0,36	0,33	0,38	0,33	-					
6. Pattern Reproduction	0,37	0,45	0,59	0,52	0,42	-				
7. Form Series	0,50	0,41	0,52	0,33	0,37	0,62	-			
8. Symbol Series	0,51	0,54	0,40	0,31	0,36	0,60	0,66	-		
9. Fret Repetition	0,21*	0,34	0,29	0,23	0,26	0,42	0,26	0,37	-	
10. Fret Continuation	0,36	0,38	0,39	0,27	0,19*	0,46	0,35	0,38	0,60	-

$N = 76$

$\bar{r}_x = 0,41$

* Not significant at the 5% level of confidence

The Lambda statistic for the four comparisons undertaken was as follows:

(i) Within-tribe comparisons

Illiterate Venda x Literate Venda $\lambda = 91,54$ $df = 55$ $p < 0,01$

Illiterate Pedi x Literate Pedi $\lambda = 52,69$ $df = 55$ $p > 0,05$

(ii) Between-tribe comparisons

Illiterate Venda x Illiterate Pedi $\lambda = 41,18$ $df = 55$ $p > 0,05$

Literate Venda x Literate Pedi $\lambda = 68,79$ $df = 55$ $p > 0,05$

It is apparent that with one exception of the Venda illiterate by literate comparison the equality of the covariances across the experimental groups may be assumed.

The findings of the Box-Wilks Test applied to comparisons in both matched samples would seem to suggest that significant differences in the patterning and possibly the structure of the cognitive abilities would appear indicated in the case of certain isolated mental abilities. However, as already stated, it is doubtful whether factor analysis will be able to confirm theoretically expected factor structures given the present test battery. Nevertheless, preliminary analyses were performed and will be summarized briefly in the following section.

2.3.3. Factor Analyses

Using the matrix of intercorrelations for the total sample in matched study "A", a maximum likelihood factor analysis was performed. The intercorrelation matrix appears in Table 32. Four factors were extracted and the matrix of factor loadings was rotated to simple structure by means of an oblique rotation which used as a point of reference the expected factor structure shown in Table 23. The results of this target factor analysis are reported in Table 33 below. The square root of the average squared deviation was computed and was found to be 0,125 which represents a reasonable fit of the data to the target.

...../48

TABLE 32

Test Intercorrelation Matrix for Matched Sample "A" (N = 396)

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,62	-								
3. Cube Construction	0,44	0,38	-							
4. Tripod Assembly	0,55	0,40	0,56	-						
5. Form Perception	0,44	0,37	0,43	0,42	-					
6. Pattern Reproduction	0,50	0,57	0,61	0,54	0,46	-				
7. Form Series	0,42	0,50	0,49	0,43	0,41	0,63	-			
8. Symbol Series	0,48	0,54	0,51	0,42	0,39	0,66	0,71	-		
9. Fret Repetition	0,39	0,49	0,45	0,36	0,44	0,51	0,44	0,46	-	
10. Fret Continuation	0,40	0,50	0,50	0,37	0,41	0,59	0,49	0,52	0,70	-

All intercorrelations significant at the 5% level of confidence.

TABLE 33

Matched Sample "A". : Oblique Factor Matrix After Rotation to a Partially Specified Target.

Test	I	II	III	IV
1. Sorting I	0,93	0,13	- 0,08	-0,07
2. Sorting II	0,52	-0,15	- 0,27	0,20
3. Cube Construction	- 0,12	0,69	0,16	0,10
4. Tripod Assembly	0,18	0,66	0,02	- 0,08
5. Form Perception	0,15	0,30	0,04	0,20
6. Pattern Reproduction	0,03	0,31	0,48	0,12
7. Form Series	0,00	0,02	0,83	- 0,03
8. Symbol Series	0,09	- 0,05	0,86	- 0,04
9. Fret Repetition	0,06	0,03	- 0,07	0,84
10. Fret Continuation	0,01	0,06	0,07	0,74

Factor Correlations

	I	II	III	IV
I	1,00			
II	0,62	1,00		
III	0,60	0,64	1,00	
IV	0,51	0,56	0,67	1,00

..../50

The tests were also intercorrelated for sample "B" using the product-moment technique (See Table 34 for the input matrix). The inter-correlation matrix was subjected to a Jöreskog [21] (1963) factor analysis, and a range of solutions of from one to four factors was computed by rotating the factor matrix to simple structure in each case, following the direct quartimin technique. Tables 35 to 38 present the rotated factor matrices, together with estimates of test-communality, specificity and uniqueness, for each solution.

It was decided in addition to proceed with analysis of the factor structures describing test performance in each of the experimental groups despite the failure to reference all extracted factors by at least three tests. These findings will be considered only insofar as tentative conclusions may be drawn. The results have not been published in the report, except where relevant to the discussion.

Discussion

Before matching the Venda and Pedi samples in terms of age and education, the impression gained was one of Pedi rather than Venda superiority in certain isolated cases of test performance. It was concluded that where consistent Pedi superiority in test performance occurred, this was to be noticed most strikingly in the case of three of the four sub-tests in the General Adaptability Battery. The question was then asked relating to the extent to which superior performance on the G.A.B. remained significant in the event of controlled comparison.

As was indicated in the previous section of the report, matching of experimental samples in respect of age and education was successfully achieved. Matching was performed in such a way that two sets of experimental samples were created. To recapitulate, these were:

(i) Matched Sample "A": comprising Rural Venda, Rural Pedi, Urban Venda and Urban Pedi groups

..../51

TABLE 34

Test Intercorrelation Matrix for Matched Sample "B" (N: 304)

Test	1	2	3	4	5	6	7	8	9	10
1. Sorting I	-									
2. Sorting II	0,59	-								
3. Cube Construction	0,53	0,40	-							
4. Tripod Assembly	0,55	0,37	0,61	-						
5. Form Perception	0,48	0,37	0,39	0,42	-					
6. Pattern Reproduction	0,55	0,57	0,64	0,57	0,45	-				
7. Form Series	0,52	0,55	0,53	0,45	0,42	0,66	-			
8. Symbol Series	0,51	0,55	0,51	0,40	0,36	0,63	0,71	-		
9. Fret Repetition	0,38	0,49	0,46	0,40	0,44	0,53	0,44	0,43	-	
10. Fret Continuation	0,42	0,46	0,51	0,41	0,43	0,58	0,51	0,49	0,71	-

All intercorrelations significant at the 5% level of confidence

TABLE 35

Rotated Factor Matrix : One Factor Solution for Sample "B"

Test	I	Reliability ($r_{t\,t}$)	Communality (h^2)	Uniqueness (u^2)	Specificity (s^2)
1. Sorting I	0,70	0,82	0,49	0,51	0,33
2. Sorting II	0,69	0,92	0,47	0,53	0,45
3. Cube Construction	0,72	0,82	0,52	0,48	0,30
4. Tripod Assembly	0,65	0,81	0,42	0,58	0,39
5. Form Perception	0,57	0,70	0,33	0,67	0,37
6. Pattern Reproduction	0,82	0,78	0,67	0,33	0,11
7. Form Series	0,77	0,91	0,59	0,41	0,32
8. Symbol Series	0,74	0,80	0,55	0,45	0,25
9. Fret Repetition	0,68	0,92	0,46	0,54	0,46
10. Fret Continuation	0,72	0,93	0,52	0,48	0,41

TABLE 36

Rotated Factor Matrix : Two Factor Solution for Sample "B"

Test	I	II	h^2	u^2	s^2
1. Sorting 1	0,79	-0,09	0,53	0,47	0,29
2. Sorting II	0,63	0,09	0,48	0,52	0,44
3. Cube Construction	0,62	0,14	0,53	0,47	0,29
4. Tripod Assembly	0,61	0,06	0,43	0,57	0,38
5. Form Perception	0,34	0,28	0,34	0,66	0,36
6. Pattern Reproduction	0,72	0,14	0,68	0,32	0,10
7. Form Series	0,83	-0,06	0,63	0,37	0,28
8. Symbol Series	0,82	-0,08	0,59	0,41	0,21
9. Fret Repetition	-0,01	0,81	0,64	0,36	0,28
10. Fret Continuation	0,09	0,75	0,66	0,34	0,27

...../53

TABLE 37

Rotated Factor Matrix: Three Factor Solution
For Sample "B".

Test	I	II	III	h^2	u^2	s^2
1. Sorting I	0,34	0,53	-0,09	0,57	0,43	0,25
2. Sorting II	0,61	0,02	0,14	0,52	0,48	0,40
3. Cube Construction	0,08	0,64	0,11	0,60	0,40	0,22
4. Tripod Assembly	-0,07	0,81	0,01	0,59	0,41	0,22
5. Form Perception	0,04	0,36	0,27	0,36	0,64	0,34
6. Pattern Reproduction	0,43	0,34	0,15	0,69	0,31	0,09
7. Form Series	0,79	0,04	0,01	0,68	0,32	0,23
8. Symbol Series	0,84	-0,04	0,00	0,66	0,34	0,14
9. Fret Repetition	0,00	0,00	0,82	0,67	0,33	0,25
10. Fret Continuation	0,08	0,03	0,76	0,68	0,32	0,25

TABLE 38

Rotated Factor Matrix : Four Factor Solution

For Sample "B"

Test	I	II	III	IV	h^2	u^2	s^2
1. Sorting I	0,18	-0,04	0,36	0,49	0,66	0,34	0,16
2. Sorting II	0,40	0,19	-0,10	0,44	0,62	0,38	0,30
3. Cubes	0,19	0,11	0,65	-0,10	0,65	0,35	0,17
4. Tripod	-0,02	0,02	0,74	0,08	0,61	0,39	0,20
5. Form Perception	-0,05	0,30	0,25	0,27	0,40	0,60	0,30
6. Pattern Reproduction	0,46	0,17	0,35	-0,01	0,71	0,29	0,07
7. Form Series	0,77	0,02	0,07	0,02	0,71	0,29	0,20
8. Symbol Series	0,81	0,01	0,00	0,02	0,69	0,31	0,11
9. Fret Repetition	-0,03	0,86	-0,02	0,02	0,69	0,31	0,23
10. Fret Continuation	0,08	0,79	0,04	-0,06	0,70	0,30	0,23

.../54

(ii) Matched Sample "B": comprising Illiterate Venda, Illiterate Pedi, Literate Venda and Literate Pedi groups.

Before discussion of the effects of such matching on comparative test performance it would first perhaps be best to enquire into the suitability of the test battery for the type of subject included in the study. The discussion will then proceed as follows:

(i) analysis of the effects of matching on (a) mean test score comparisons and (b) structure of intellect comparisons in terms of the interaction of tribe and urbanization (study "A").

(ii) analysis of the effects of matching on the above two points of comparison in terms of the interaction of tribe and education (study "B").

(iii) analysis of the pattern of test interrelationships in both matched studies.

(iv) analysis of the differentiation of abilities in specific sub-groups by means of factor analysis

(v) general synopsis.

3.1 Suitability of the test battery.

Inspection of the reliability coefficients calculated for each test in each experimental group (see Tables 9-12 and 16-19) reveals that with the one exception of the Form Perception Test, good measures of internal consistency were yielded, indicating that for the most part the tests included in the battery are of an appropriate level of difficulty for all samples. With the exception of Fret Repetition and Form Perception, most test score distributions tended to platykurtosis while negative skewness became a noticeable feature only in the case of some test score distributions in urban and literate samples.

For purposes of the present investigation, it may be assumed

...../55

that the majority of tests in the comparative battery are appropriate for all the matched samples.

3.2 The effects of matching on comparative findings.

A major observation which may be made is that matching for education and age does not reduce dramatically many of the differences present in pre-matched comparisons. It may, however, be assumed in explaining such differences as persist after matching, that factors other than age and education are operative. In exploring the psychological significance of differences that remain when mean test scores are compared under matched conditions, a three-tier system will be followed:

- First, it is reasonable to enquire whether the observed differences may be attributed to departures from standard test-administration procedures.

- Then, if this factor cannot account for the differences, explanation at the level of differing employment histories and experience of the samples will be considered.

- Finally, should explanation at this level not suffice, only then would attention be focussed on the possibility that traditional cultural factors could provide clarification.

3.2.1. Matched Study "A" (tribe by urbanization interaction)

Beginning with the analysis of the interaction of tribal affiliation and urbanization, inspection of Table 14 indicates that in the within tribe analyses, urban Venda have obtained mean test scores significantly superior to rural Venda on all the tests in the battery. Similarly, urban Pedi scores were significantly higher than those of rural Pedi in the case of eight out of ten comparisons (differences in respect of Sorting II and Fret Repetition did not attain significance).

In the case of the within-tribe Venda comparison, the finding may be attributed to the beneficial effects of urbanization on cognitive performance, for it is known from the results of the

...../56

Urban-Rural Scale (Grant[22], 1969a and b[23]) that urban-resident Vendas were more urbanized in the psychocultural sense of the term than were rural-resident Vendas. In the case of the Pedi comparison, urbanization per se may not be concluded to have produced the differences that were observed in favour of the urban-resident sample, for this sample were no more urbanized than were their rural-resident counterparts. Two factors could have contributed to these differences, though. Given the observation that the Pedi urban-resident sample were strongly rural-oriented, a process of sample pre-selection could have been operating whereby the " brighter " or more progressive-minded rural Pedi would be more likely to gain employment in the city as a contract labourer. Hall's[24] (1971) analysis of the work histories of the urban-resident sample adds weight to the argument that the Pedi " urban " sample are, predominantly, migrant labourers from the rural homeland. In addition to such pre-selection, the factor of industrial experience gained in an urban area is also more than likely partly responsible for superior urban Pedi test performance. Thus, it could be that one specific aspect of modernity, viz. urban-industrial experience in the absence of full urbanization, has produced a noticeable improvement in test performance. A final factor to consider is that testing conditions themselves, in terms of physical comfort (illumination, temperature, extraneous noise and seating arrangement) were more favourable at the urban than at the rural test-centre.

Turning now to the between tribe comparisons for matched sample "A", it is to be seen from Table 15 that the Pedi rural group obtained mean scores significantly higher than the means for their Venda counterparts on three tests (Sorting I, Sorting II and Tripod) while Venda rural subjects obtained a mean test score superior to the Pedi in the case of Fret Continuation only.

...../57

This one incident of Venda superiority could be explained by reference to a difference in testing procedure in that while the practice items were administered by means of standard posters to the Venda, blackboard diagrams were used for the Pedi.

Superior rural Pedi performance in terms of three of the G.A.B. sub-tests may however be attributed to factors other than differences in test administration. An interesting finding emerged from an analysis of rural Venda and Pedi work histories, viz. that 70% of the rural Pedi had had some mining experience at one stage or another during their working history, while this was true of only 2% of the rural Venda sample. This means that in the first place, 70% of the rural Pedi sample had at some stage already been screened by the G.A.B. and were thus in a sense already exposed to the sub-tests therein, while in the second place, mining experience itself could have resulted in superior performance. The effects of test-retest on the G.A.B. scores might be expected to be minimal given the probable lapse of many years between original test and retest. Mining experience on the other hand could have left its mark through either lashing experience (which would provide practice at tasks requiring a perceptual sorting ability under speeded conditions) or through mechanical experience (resulting in familiarity with the uses of nuts and bolts, screws and washers and other items employed in the G.A.B. sub-tests.) It is thus conceivable that mining experience per se has brought about an improvement in test performance which becomes evident on contrasting one group of individuals with such experience against another group lacking this experience.

Looking at tribal differences in urban comparisons, it would appear that any initial advantage which Pedis may have had over Vendas disappears entirely. Table 15 indicates that not one single t-value between mean test scores has reached significance. At first glance, a comparison of the two sub-tables in Table 15 tempts

..../58

one to infer that acculturation in the sense of urban-residence has the effect of bringing about greater homogeneity in cognitive performance by overriding any initial differences observed between unacculturated samples. This is probably the case, but stated differently what appears to happen is that urban-residence enables members of different tribes to compete for similar types of employment thereby resulting indirectly in cognitive homogeneity. Thus, it is expected that had work opportunities in the rural homelands been equal for both tribal samples, no tribal differences on present cognitive measures would have been observed.

It would appear from the above that, tentatively stated, work opportunity is a more important factor in contributing to human adaptability than is tribal affiliation per se.

We come now to the question of possible differences both within and between tribal samples in terms of the structure of intellect. Box-Wilks Tests carried out to test the equality of the covariance matrices in each experimental group suggest that differences in the patterning of broad abilities assumed to underlie test performance do not differ markedly from sample to sample. Thus, if adequate factorial study of test-intercorrelations were possible, it would be expected that in all probability, the number and nature of mental abilities that could be described would be similar for each group and that furthermore, the patterning of such abilities might not differ to any marked extent. However, in the case of one of the comparisons, viz. Rural Venda by Rural Pedi which produced a significant difference in covariance structure at the 5% level of confidence, it might be argued that greater mining experience on the part of the Pedi could, in fact have contributed to a change in the structure of abilities of Pedis compared with their Venda counterparts. The inability to reference each of the expected factors that might emerge from a factor analysis (see Table 33) by at least three tests, makes this speculation difficult to confirm. Nevertheless, at a later point

..../59

in the discussion, an attempt will be made to explore the significance of the above finding more thoroughly.

3.2.2. Matched study "B" (tribe by education interaction)

Inspection of Table 21 reveals that literacy is strongly associated with improved test performance on the part of both Venda and Pedi samples. It is interesting to note that the Tripod Assembly Test does not appear to be significantly related to education for both Venda and Pedis while Cube Construction displays a similar non-significant relationship in the Venda but not the Pedi comparison. The observed t-value for Pedis was very low, however, as was the t-value in respect of Form Perception for both tribal samples. These three tests: Tripod Assembly, Cube Construction and Form Perception, share a number of features in common. They are all performance-type tests which do not require the use of paper and pencil. Then too, they all rely in large measure on the utilization of spatial-perceptual and manipulative skills such as rotation of the component parts of the test to fit the perceived final product or model, and discrimination between " correct " and " misleading" solutions. In terms of factorial studies carried out on these three tests in the past, it would appear that all are of an esentially "spatial" nature. It might appear, then, that formal education does not influence the spatial abilities of pre-literates and semi-literates as markedly as it does the abilities that are assumed to underlie performance of a more perceptual-analytic or conceptual nature.

An interesting speculation concerning the utilization of African labour in industry follows from the above. Provided it can be assumed that tests such as Tripod Assembly and Cube Construction do in fact measure a spatial component of intellect, and provided an empirical relationship be established between performance on those tests and some measure of industrial

..../60

competence in the execution of lower-grade tasks, then education need not be a critical criterion in selecting individuals to perform such tasks. In South Africa's Bantu Homelands, where much of the potential labour force has received little or no formal schooling, this assertion, if empirically supported, could be of importance.

Inspection of Table 22 points to two further differences apparent between Pedis and Vendas. In the first place, literate Pedis appear to achieve significantly higher mean test scores on the two Sorting tests than do their Venda equivalents, which might again be a function of the greater degree of mining experience on the part of rural Pedis. Secondly, illiterate Pedis appear to have scored significantly higher than illiterate Vendas in the case of two tests believed to be measures of conceptual reasoning ability, viz. the Form Series Test and Pattern Reproduction Test. Both tests now form part of the new Classification Test Battery (C.T.B.) which replaced the G.A.B. as a screening device for novice mine recruits. It has been demonstrated that the predictive validity of these two tests for mining jobs is far superior to the best sub-tests in the G.A.B. (viz. Sorting II and Cube Construction).

The significance of the above finding is difficult to interpret. In order to argue that there possibly might be a difference between tribes at the unacculturated level in terms of conceptual reasoning ability, it would need to be demonstrated that the Symbol Series Test should at least also yield a significant t-value. This was not the case, neither was there found to be any measure of significance between illiterate Venda and Pedi covariances when the Box-Wilks Test was applied. It would appear then that, in so far as an actual difference in ability structure between the two groups is concerned, there is little to support the assumption that conceptual reasoning processes represent a fully developed ability among illiterate Pedi but not among illiterate Venda. Furthermore, from anthropological accounts of the two tribes, it is impossible to argue with any degree of certainty that traditional Pedi culture

..../61

is better able to foster the growth of conceptual reasoning ability than is the traditional Venda culture. On the contrary, there is more evidence to suggest that cultural differences between Vendas and Pedis are less obvious than the tremendous cultural similarities between the two groups. Stayt[25] (1968) has remarked that the fact that Pedis and Vendas may attend the same initiation school is of great importance for it provides a means of facilitating the formation of a centralizing process regarding inter-tribal relationships and "mentality".

It would appear possible that the test-score differences in respect of the Form Series Test (F.S.T.) and Pattern Reproduction might not be related to cultural factors although this cannot be over-ruled completely. It will be remembered from the discussion of the contents of Table 2 in the introduction that the comparison of Venda and Pedi rural illiterate groups (i.e. the most highly tradition-oriented group) represented a valid comparison under conditions of control over the age variable. In this comparison, F.S.T. and Pattern Reproduction mean test scores did not differ significantly for the two groups. However, in the urban illiterate comparison, the t-value for F.S.T. was significant at the 5% level of confidence while the t-values for Symbol Series and Pattern Reproduction were sizeable by comparison with the other tests in the battery. This comparison was not a valid matched comparison however. It could be argued from the above that despite matching fro age, the differences in favour of illiterate urban Pedis in respect of the F.S.T. in particular have been carried over into the Venda-Pedi illiterate comparison, (in which half of the subjects are urban-resident). It would appear then that the result is attributable to the interaction of tribal affiliation and urbanization under conditions of illiteracy. Thus, superior Pedi performance on the F.S.T. might be due to factors associated with either the direct effect of urban-industrial experience, or with a generally more favourable predisposition of illiterate Pedis

..../62

to adapt to the demands of western industrial society compared with their Venda counterparts.

Tentatively, it can be concluded that illiterate Pedis residing and working in urban areas would appear to have a slight edge on their illiterate Venda counterparts (of equivalent age) as regards certain conceptual reasoning processes. Whether this can be attributed to more effective adaptation to western societal demands owing to fewer cultural inhibitions, or whether it is attributable to factors peculiar to the samples investigated cannot be answered. Nevertheless, two questions will be posed, and will be left open to further research.

(i) Pedi culture may in fact foster a more favourable facility for adaptation to a western environment than does the Venda culture. This facility may remain latent in the rural homeland, but may become activitated in an appropriate urban environment. Anthropologists have often remarked on the apparent resistance of Vendas to acculturation, while similar remarks have not been made in accounts on the Pedi.

(ii) Linked to the above speculation is a second which supposes that illiterate migrant Pedi workers might hold more progressive attitudes towards earning a livelihood than do illiterate urban-resident Venda workers.

In any event, with increasing educational opportunities for members of all tribes in South Africa, such subtle differences in intellectual performance between illiterates will prove to become matters of little practical importance for the future. Literacy appears to bring about greater homogeneity in cognitive performance between members of different ethnic groups. The literate Venda-Pedi comparison in Table 22 points to the disappearance of superior Pedi performance on conceptual reasoning tests.

The Box-Wilks Test findings relating to within tribe comparisons of covariance matrices in Study "B" present a major problem in

.../63

that a conclusion reached in this study on the Pedi (Kendall[26], 1971) where matching for age and education was not attempted, appears to be refuted. In the present comparative study, no significant covariance differences were observed between matched Pedi literates and illiterates whereas highly significant differences were reported in the study where no matching for these variables was attempted. Grant's[27] conclusion that Venda literate and illiterate covariance structures differed significantly was however, confirmed in the matched study.

Between-tribe analyses in terms of the Box-Wilks Test indicated that covariance matrices did not differ in structure between Pedi and Venda literates and between Pedi and Venda illiterates.

Before seeking a coherent explanation of the above findings it might be well to present briefly the trends emerging from the analysis of inter-test correlations for the various matched samples. Such trends could give clues as to the extent of intellectual differentiation of cognitive abilities under varying conditions of acculturation.

3.3.1. Test interrelationships: matched sample "A"

Tables 24 to 27 present the test intercorrelations for the four sub-samples in the tribe by urbanization interaction study. It has been assumed by students of cognitive differentiation that the lower a correlation between tests in a battery, the greater the extent of mental differentiation or " specialization ". In this connection, average intercorrelations were computed for each sample, and it was discovered that the most highly differentiated group, by the above criterion was the Urban Venda sample ($r_{\bar{x}} = 0,44$). The least differentiated were rural Vendas ($r_{\bar{x}} = 0,51$). The range of average coefficients for the four groups is thus not great, and certainly not sufficient to argue

.../64

that there is a significant degree of difference between the extent of differentiation in the two extreme samples. The difference between average coefficients for the two Pedi samples is even smaller ($\bar{r}_x$ for Rural Pedis = 0,45 and for Urban Pedis; 0,48 - indicating a reversal in the expected trend). In conclusion it may be stated that no trend is evident to suggest that acculturation in the sense of urbanization actively facilitates greater differentiation between cognitive processes. Alternatively it can be concluded that the extent of cognitive differentiation for the four experimental groups is broadly identical.

3.3.2. Test interrelationships: matched sample "B"

Slightly more encouraging evidence for the relationship between acculturation and differentiation is possibly to be seen in the tribe by education interaction analysis of test intercorrelations. Referring to Tables 28 to 31 it is to be noted that the most differentiated sample are the Literate Pedi ($\bar{r}_x$ = 0,41) while the least differentiated are Illiterate Pedi ($\bar{r}_x$ = 0,52). Literate and Illiterate Venda average coefficients (0,46; 0,51 respectively) do not vary as widely as do Pedi coefficients.

The above observation is difficult to reconcile with the Box-Wilks Test findings for Matched Sample "B" in that whereas Pedi comparisons reveal a wider range between average test-intercorrelations (a difference of 0,11) than the Venda comparisons (difference of 0,05), covariance matrices differ significantly for the Venda but not for the Pedi.

The only answer to the above problem would be to carry out separate factor analyses for the four experimental groups, even though it is borne in mind that factorial determination cannot be adequate. It could be hypothesized that by means of a standard criterion for deciding upon the most parsimonious number of factors to extract for each group, certain groups would yield more factors than certain others. In the case of

...../65

the present problem, considering the Box-Wilks findings and those from averaging intercorrelations, it might be possible to hypothesize that either:

(i) Literate Vendas have at their disposal more distinct cognitive abilities than do Illiterate Vendas, Illiterate Pedis of Literate Pedis, or

(ii) Illiterate Vendas have at their disposal fewer distinct cognitive abilities than do Literate Vendas, Literate Pedis or Illiterate Pedis.

The author intuitively, and on the basis of other findings already mentioned in this report, would support the second alternative.

3.4 Preliminary factor analytic study

As was fully expected at the outset, factor analyses were not satisfactory. Using the target specified in Table 23 wherein four factors were extracted, a reasonable fit of the data to the target matrix was achieved (see Table 33) but it is clear that the psychological value of the findings is limited by the fact that two of the factors emerged as doublets while the remaining two appear in unsatisfactory determinative form. It is also clear that the four factors are highly intercorrelated. Tables 35 to 38 indicate furthermore that a 1-factor solution is as equally preferable as are 2-, 3-, or 4- factor solutions.

Consideration of two statistical criteria commonly applied to determine the optimum number of factors to extract during analysis proved, furthermore, to be of limited assistance. Kaiser's "Little Jiffy 2 " criterion (Kaiser,[28] 1970), a highly conservative index, pointed to the acceptance of the 1-factor solution whereas Jöreskog's index (Jöreskog,[29] 1963 Ch. IV) bestows acceptability on the 4-factor solution.

Nonetheless, it was decided to proceed with the analysis of factor structures describing the performance or each of the eight separate experimental groups. Table 39 summarizes the number of factors indicated by means of Kaiser's and Jöreskog's criteria for each group.

TABLE 39

No. Factors According To:	Sample "A"				Sample "B"			
	Rural		Urban		Illiterate		Literate	
	Venda	Pedi	Venda	Pedi	Venda	Pedi	Venda	Pedi
(i) Kaiser's "Little Jiffy 2 "	1	2	1	2	2	I	1	2
(ii) Jöreskog Probability (p)	4	3	3	4	3	2	2	3

Kaiser's criterion (which in view of the composition of the present test battery might be the more acceptable of the two indices) suggests that there is no difference between rural and urban Vendas and between rural and urban Pedis in respect of the extent to which abilities are differentiated. On the other hand, there would appear to be a cross-tribal difference both in the case of rural and urban comparisons wherein Pedi samples would appear to be more differentiated than the Venda. This observation supports the trend that was noticed on comparing the average test-intercorrelations of rural Venda and Pedi and urban Venda and Pedi (see Tables 24-27) However, only in the case of the rural Venda and Pedi comparison does a difference in degree of differentiation seem to be accompanied by a significant change in the structure of mental abilities. As will be argued in the conclusion stage of the discussion, the significance of the above findings will be attributed to employment factors rather than to tribal-affiliation as such.

Kaiser's criterion applied to the four sub-groups in Sample "B" presents a disturbing finding. The conclusion reached by Grant[30] that Venda literates bring into play fewer abilities in solving a diverse array of tests than do Venda illiterates is again confirmed, this time under conditions of matched control with Pedi samples. This assertion is entirely contradictory to what the differentiation hypothesis would predict. On the other hand, Kendall's[31] finding that differentiation is facilitated by literacy is also re-affirmed

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in the present study. The paradox thus remains, and it is no longer possible to argue that the Venda findings are an anomaly which may be attributed to the presence of too many multi-dimensional tests in the Venda battery or to procedures in Grant's factor analysis which differed from Kendall's, for in the present study, the test-batteries and statistical procedures were identical for both tribal samples.

In conclusion, it could be stated that little clarification of the major issues pertaining to the differentiation of abilities seems to be afforded by factor analyses alone. An attempt will be made by way of a general synopsis to integrate the findings that emerge from the other techniques of analysis. Support from factor analysis will be added only where it is felt that further light can be shed on the more important findings emerging from the other forms of analysis (i.e. difference between means tests; equality of covariances tests and inter-correlations).

3.5 Synopsis

The synopsis will endeavour to integrate the major findings in this study. Discussion will centre around two significant sample comparisons, viz. rural Venda versus rural Pedi; and illiterate Venda versus literate Venda.

It was observed that rural Vendas and Pedis were characterized by differing test-covariance structures. Difference between means tests for this comparison indicated that rural Pedis scored significantly higher than did rural Vendas on three spatial-perceptual tests. Rural Pedis were also shown to be characterized by a greater degree of mining experience than were rural Vendas. It could be hypothesized from the above that through mining experience, a fuller development of skills characterized by spatial manipulation under speeded conditions and by simple perceptual discrimination under speeded conditions would explain the differences observed

..../68

in covariance structure. As a crude test of this hypothesis, it was decided to establish for both groups a multiple correlation between Sorting I, Sorting II and Tripod Assembly on the one hand and the remaining tests in the battery on the other. If it could be ascertained that the multiple correlation so derived was lower for rural Pedis than for rural Vendas, a tentative conclusion could be reached that factors associated with mining experience have contributed to greater differentiation between certain abilities. Holzinger and Harman[32] (1941) have described a technique whereby battery intercorrelations may be computed. If it could be assumed that that Sorting I, Sorting II and Tripod Assembly comprised test-battery q and the remaining seven tests, battery Q, then the multiple correlation between the two batteries would be arrived at by means of the following formula:

$$r_{q\,Q} = \frac{\square qQ}{\sqrt{q + 2\Delta q}\ \sqrt{Q + 2\Delta Q}}$$

where: $\square qQ$ = the sum of the elements (intercorrelations) between battery q and battery Q

Δq = the sum of the elements in battery q

ΔQ = the sum of the elements in battery Q

q = the number of elements in battery q

Q = the number of elements in battery Q

By means of this formula, it was determined that the battery correlation for rural Vendas was 0,65 while for rural Pedis it was 0,52. The statistical significance of the difference betwen these coefficients cannot be tested. Nonetheless, a trend favouring the hypothesis is apparent. It is interesting to note too that the average intercorrelation of all the tests in the battery for Rural Pedis was slightly lower than that for Rural Vendas (see Tables 24 and 25). On the basis of the above argument then, it could

...../69

be concluded that the difference between covariance matrices for the two rural samples could relate to the differentiation of a "spatial-speed" component of intellect as a function of mining experience on the part of the Pedi. This intellectual component could be looked upon as the beginnings of two distinct abilities measurable in illiterates and semi-literates, viz. perceptual speed and space.

Given the significant Box-Wilks Test finding in relation to Rural Pedi-Venda comparison, it is legitimate to suppose that a change of some sort would be reflected in the factor structures of the two groups. According to the theory of intellectual differentiation, we may expect that experience of any description which facilitates adaptation to societal demands will aid in the formation or development of mental abilities that eventually become differentiated into increasingly more independent dimensions of intellect. We have argued that the rural Pedi sample is characterized by a greater degree of mining experience than is the Venda sample. Possibly, too, general industrial experience on the part of the Pedi might be greater than for the Venda, but in any event, according to theory we can assert that the skills developed as a function of industrial experience should result in that group's developing a more highly specialized ability, centering around the processes measured by those cognitive tests which reflect significant mean differences between the two groups in the present comparison, (Sorting I, Sorting II, and Tripod). As mentioned in the previous section the Kaiser criterion of factor"significance" predicts one factor only for rural Vendas and two for rural Pedis. Inspection of the rotated matrix for the two-factor Pedi solution reveals that the second factor is, in fact referenced by the two Sorting Tests and Tripod Assembly. For ease of reference, the factor matrix has been summarized in Table 40 on the following page. For comparison, the two-factor solution for rural Vendas has also been presented (see Table 41).

../70

TABLE 40

Rural Pedi: Oblique Factor Matrix - 2 Factor Solution

Test	I	II	r_{tt}	h^2	u^2	s^2
1. Sorting I	-0,11	0,85	0,81	0,60	0,40	0,21
2. Sorting II	0,16	0,64	0,98	0,58	0,42	0,40
3. Cube Construction	0,70	0,02	0,80	0,50	0,50	0,30
4. Tripod Assembly	0,13	0,53	0,78	0,40	0,60	0,38
5. Form Perception	0,36	0,32	0,69	0,39	0,61	0,30
6. Pattern Reproduction	0,83	-0,04	0,82	0,65	0,35	0,17
7. Form Series	0,80	-0,03	0,91	0,62	0,38	0,29
8. Symbol Series	0,72	0,05	0,88	0,57	0,43	0,31
9. Fret Repetition	0,60	0,01	0,94	0,36	0,63	0,58
10. Fret Continuation	0,64	0,01	0,94	0,42	0,58	0,52

TABLE 41

Rural Venda : Oblique Factor Matrix - 2 Factor Solution

Test	I	II	r_{tt}	h^2	u^2	s^2
1. Sorting I	0,70	0,01	0,83	0,50	0,50	0,33
2. Sorting II	0,28	0,50	0,93	0,53	0,47	0,40
3. Cube Construction	0,39	0,34	0,84	0,46	0,54	0,38
4. Tripod Assembly	0,40	0,29	0,88	0,42	0,58	0,46
5. Form Perception	0,56	-0,03	0,66	0,29	0,71	0,37
6. Pattern Reproduction	0,31	0,58	0,82	0,69	0,31	0,13
7. Form Series	0,11	0,77	0,89	0,73	0,27	0,16
8. Symbol Series	-0,13	0,94	0,88	0,71	0,29	0,17
9. Fret Repetition	0,84	-0,04	0,92	0,65	0,35	0,27
10. Fret Continuation	0,79	0,08	0,92	0,72	0,28	0,20

Dimension I for rural Pedis (Table 40) would appear to describe a global perceptual-analytic or conceptual discrimination factor. The author would hesitate to call this dimension a conceptually distinct ability however. Rather, it is to be looked upon as a collection of measures related to separate elements or intellectual skills which, either through the composition of the test battery or because of the stage of intellectual differentiation characterizing the sample concerned, are not able to assert their independence as conceptually distinct mental abilities. Dimension II on the other hand, which is clearly referenced by most of the tests performed under speeded conditions, could be called " perceptual speed " and there is justification for considering its equivalence to an ability. The high specificities reported for the two Fret tests are also worthy of note in that it appears that the perceptual analytic factor in African intellect is ready to assert its conceptual independence at the stage of development reached by the rural Pedi sample, and possibly would have emerged as a full factor had there been other suitable reference tests in the battery. Dimensions I and II intercorrelate to the extent of 0,72 however.

By comparison, the 2-factor structure for rural Vendas presents a completely different picture. It should be remembered that Kaiser's criterion suggested that the extraction of one factor would have been sufficient to account for most of the common variance between tests. Dimension II appears to represent a conceptual reasoning factor. Dimensions I and II for rural Vendas correlate with each other to the extent of 0,73; again an extremely high coefficient. The reader might object that there is little justification for serious consideration of the above finding. Nevertheless, it is interesting to note that, in the one instance where it was known that one of the experimental groups differed from the other in terms of mining

...../74

experience, this is paralleled by a factor structure and factor patterning which differs from that of an experimental group without such experience.

In conclusion it may be suggested that mining experience on the part of the Pedi rural sample is either in some way associated with, or has actually contributed to the overall cognitive adaptability of that sample by furthering the differentiation of a specific ability, perceptual speed, which is functionally useful in meeting the demands of western technological society. This conclusion is based on a number of findings which are interrelated in coherent manner.

The second significant finding emerging from the analysis previously described is that group covariances differed significantly between Venda literates and illiterates but not between Pedi literates and illiterates. In both ethnic comparisons however, performance on the majority of tests in the battery was at a higher level for literates than for illiterates. Furthermore, the average test intercorrelations for Pedi illiterate was considerably higher than for literates while this difference was less marked in the Venda comparison. Finally, Kaiser's criterion for extracting a specific number of factors indicated a 1-factor solution for Venda Literates and Pedi Illiterates, but 2-factor solutions for Venda Illiterates and Pedi Literates. The various findings are extremely difficult to integrate into a logical, coherent picture, but if it be true that Venda literate by illiterate covariance matrices differ significantly while those for the Pedi comparison do not, then this should be reflected in the equivalence of factor structure for Pedis but not for Vendas. Consequently, it was decided to compare all four experimental groups on a 2-factor solution. The rotated factor matrices for the four groups are presented in Tables 42-45. It would be expected that the factor matrices for the two Pedi groups and for Venda literates should not differ appreciably, whereas that for Venda Illiterates should reveal certain differences, at least by comparison with the structure for Venda Literates.

.../73

TABLE 42

Venda Illiterates : Oblique Factor Matrix - 2 Factor Solution

Test	I	II	r_{tt}	h^2	u^2	s^2
1. Sorting I	0,44	0,36	0,80	0,54	0,46	0,26
2. Sorting II	0,35	0,36	0,94	0,41	0,59	0,53
3. Cube Construction	0,45	0,35	0,84	0,53	0,47	0,31
4. Tripod Assembly	0,52	0,32	0,85	0,58	0,42	0,27
5. Form Perception	0,67	-0,06	0,79	0,40	0,60	0,39
6. Pattern Reproduction	0,55	0,30	0,77	0,62	0,38	0,15
7. Form Series	0,10	0,78	0,89	0,72	0,28	0,17
8. Symbol Series	-0,06	0,84	0,84	0,63	0,37	0,21
9. Fret Repetition	0,89	-0,12	0,91	0,67	0,33	0,24
10. Fret Continuation	0,79	0,04	0,92	0,67	0,33	0,25

TABLE 43

Venda Literates : Oblique Factor Matrix - 2 Factor Solution

Test	I	II	r_{tt}	h^2	u^2	s^2
1. Sorting I	0,61	0,22	0,88	0,61	0,39	0,27
2. Sorting II	- 0,05	0,74	0,84	0,50	0,50	0,34
3. Cube Construction	0,80	0,01	0,80	0,65	-0,35	0,15
4. Tripod Assembly	0,82	- 0,14	0,82	0,54	0,46	0,28
5. Form Perception	0,53	0,09	0,70	0,36	0,64	0,34
6. Pattern Reproduction	0,45	0,50	0,78	0,78	0,22	0,00
7. Form Series	0,01	0,77	0,89	0,61	0,39	0,28
8. Symbol Series	0,17	0,70	0,89	0,69	0,31	0,20
9. Fret Repetition	0,48	0,00	0,78	0,23	0,77	0,55
10. Fret Continuation	0,43	0,22	0,84	0,37	0,63	0,47

.../76

TABLE 44

Pedi Illiterates : Oblique Factor Matrix - 2 Factor Solution

Test	I	II	r_{tt}	h^2	u^2	s^2
1. Sorting I	0,83	-0,07	0,77	0,53	0,47	0,24
2. Sorting II	0,69	0,06	0,92	0,55	0,45	0,37
3. Cube Construction	0,40	0,43	0,82	0,59	0,41	0,23
4. Tripod Assembly	0,53	0,18	0,77	0,45	0,55	0,32
5. Form Perception	0,18	0,49	0,76	0,40	0,60	0,36
6. Pattern Reproduction	0,58	0,31	0,77	0,69	0,31	0,08
7. Form Series	0,56	0,30	0,92	0,63	0,37	0,29
8. Symbol Series	0,47	0,30	0,86	0,50	0,50	0,36
9. Fret Repetition	0,01	0,83	0,92	0,69	0,31	0,23
10. Fret Continuation	-0,02	0,89	0,94	0,76	0,24	0,18

TABLE 45

Pedi Literates : Oblique Factor Matrix - 2 Factor Solution

Test	I	II	r_{tt}	h^2	u^2	s^2
1. Sorting I	0,78	-0,15	0,79	0,50	0,50	0,29
2. Sorting II	0,57	0,10	0,92	0,41	0,59	0,51
3. Cube Construction	0,63	0,08	0,83	0,46	0,54	0,37
4. Tripod Assembly	0,62	-0,04	0,81	0,36	0,64	0,45
5. Form Perception	0,52	0,00	0,64	0,27	0,73	0,37
6. Pattern Reproduction	0,60	0,27	0,79	0,63	0,37	0,16
7. Form Series	0,75	-0,01	0,91	0,56	0,44	0,35
8. Symbol Series	0,67	0,12	0,89	0,55	0,45	0,34
9. Fret Continuation	-0,02	0,72	0,96	0,50	0,50	0,46
10. Fret Repetition	0,11	0,64	0,94	0,51	0,49	0,43

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Test specificities for the most part are acceptably low for all four groups, though it is clear that in the case of the two Literate samples, a third factor centering on the two Fret tests seems indicated. This observation points rather well to the arbitrariness of the Jöreskog criterion. If, in terms of specificities, the large measure of variance unaccounted for by a 2-factor solution for literates does warrant the extraction of a further factor for each group, then the anomaly in respect of differentiation of abilities for Venda and Pedi literates disappears. It could then be concluded that literacy in the case of both ethnic samples promotes the growth of abilities which become differentiated the one from the other.

It is clear that the factor structures for Venda literates and illiterates do differ substantially from one another. Dimension I for Venda illiterates is referenced by all the tests save two which represent measures of conceptual reasoning ability. This parallels the two-structure solution for the Venda rural sample mentioned previously. Dimension I for Venda literates differs from that of Venda illiterates in that half of the factor-loadings increase in value relative to the illiterate picture whilst the other half either approach zero or are decreased appreciably. In the Pedi comparison, Dimension I is broadly similar for both literates and illiterates while in addition Dimension II is referenced in both cases by the Fret Tests.

No definite conclusion can be reached regarding the differences in the structure of intellect of the four groups, nonetheless inspection of the four factor structures reveals that differences in structure and patterning are more noticeable between the two ethnic groups than they are within each group. An interesting trend reveals itself in the magnitude of the correlations between Dimensions I and II across the four groups. While for the Venda groups and Pedi illiterates the coefficients are:

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Venda Illiterate ; 0,66

Venda Literate ; 0,69

Pedi Illiterate ; 0,70

that for Pedi literates is substantially lower (0,59).

As a tentative conclusion then, the author would advance the following: Pedi Literates would appear to have reached a stage of intellectual differentiation which is noticeably distinct from the remaining groups. Pedi Illiterates and Venda Literates come next, though their " abilities " in respect of adaptation to a western culture, are not as differentiated as are those of the Pedi Literate sample. Finally, while at a level of cognitive differentiation comparable to their literate counterparts, Venda illiterates seem characterized by a significantly different organization of abilities. In terms of the general adaptability construct, then, it may be suggested that in meeting the demands of western technological culture, the Pedi Literate sample seem best equipped intellectually while Pedi Illiterates and Venda Literates follow close behind. Of the four groups, Venda Illiterates would appear to be the least suitably equipped for successful adaptation to western technological culture. It must be emphasized that this conclusion is true of the Venda and Pedi samples which were studied. Vorster[33] (1972) points out that there were numerous difficulties associated with sampling which made it almost impossible, within the limits of the I.B.P. project, to obtain a representative sample of either the Venda or the Pedi. In the rural studies, confined but easily-accessible regions in the homelands were chosen (Chief Lwamondo's tribal area in Vendaland and Sekhukhuneland in the Pedi homeland). Cautious extrapolition from these samples to the wider ethnic communities should therefore be adopted in terms of general conclusions which may be drawn. Nevertheless, there is little doubt that the two rural samples represented relatively "pure" Vendas and Pedis, culturally-speaking. The urban Pedi sample was a direct match of the rural

..../77

Sekhukuneland sample and is therefore not representative of the wider Pedi community which is to be found in the urban areas of the Transvaal. The urban Venda sample is however more representative of the urban Venda population.

In explaining the conclusion drawn in the preceding paragraph wherein it appears that samples of Pedis are better equipped intellectually for adaptation to western cultural demands than are Venda samples, three broad hypotheses may be advanced. Although it has already been concluded that traditional cultural beliefs, attitudes, and values do not directly have a bearing on measures of cognitive performance, there appear to be strong indications that traditional culture is an indirect factor in facilitating or impeding the mental changes that accompany acculturation. The three broad hypotheses will be discussed in turn. They serve more to generate new avenues of research than to offer conclusive explanations for the findings observed in the present study. The hypotheses are as follows:

(i) Venda culture is more resistant to the forces of acculturation than is Pedi culture, in environments where culture change is necessary.

(ii) Historical circumstances which have defined the impact of western culture on the two tribes differ.

(iii) Venda culture, in an indirect manner, often does not permit its members to expose themselves to environments which would lead directly to acculturation.

Taking the first point, that Venda culture is more resistant to acculturation than is Pedi culture, Grant,[34] (1969a) has observed that despite many years residence in Johannesburg, the urban Venda sample proved to hold typically rural-oriented attitudes and behavioural tendencies according to the Urban-Rural Scale. Anthropologists of course, have frequently described Venda society as being "encapsulated". Throughout their history despite their relatively small numbers, Vendas have resisted the encroachment of Pedi, Shangaan, Shona and other cultures on their way of life. It is true they have assimilated much from other societies, but they have succeeded in retaining their unique cultural identity. A Venda saying summarizes the attitude of the tribe to their culture resilience very aptly. You can cook a

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Venda with a stone ; the stone melts but the Venda remains.

Secondly, at least insofar as contact with western society is concerned, it might be that the question is not so much one of voluntary cultural encapsulation as of the historical circumstances which have defined the impact of technological culture on the Venda as opposed to the Pedi. For many years, the Pedi have flocked to the gold mines of the Witwatersrand and have for long been a well-established sector of the Non-White labour force employed in secondary industry. The Venda have never been characterized by close links with urban South Africa and it is only comparatively recently that their numbers in secondary industry and in urban domestic employment have increased. It does seem that work opportunities are fewer for Vendas than is the case with the Pedi. There are, for instance fewer recruiting centres in Vendaland for employment on the mines than there are for the Pedi. Whether this situation exists because of poor response when recruitment in Vendaland was first undertaken or whether it is that Vendas because of their small numbers were overlooked as a source of manpower cannot be answered. The result is though that today mining for Vendas is not looked upon as a "traditional" avenue of employment.

Finally, the hypothesis may be advanced that Vendas have not allowed themselves to be exposed to situations which could lead to acculturation. This speculation is related strongly to tribal employment <u>preferences.</u> Mining officials have known for some time that Vendas seem reluctant to take up deep-level mining employment. Their work preferences are rather in terms of secondary industry, commercial employment and the services field. Hall and Harris[35] (1970) in their report on the motivational patterns of the Venda I.B.P. sample have observed a close correspondence between the type of work done most in working life and the subject's work preference. A similar relationship in the <u>Pedi</u> investigation (Hall,[36] 1971) was not observed for it was more difficult to demonstrate owing partly to the large measure of unemployment of the Pedi

...../79

sample. The majority of Pedis in the sample expressed preference for employment in secondary industry with an extremely low percentage choosing mining employment despite a history of work on the mines. It has been suggested that the greater degree of preference for industrial employment on the part of the Pedi is reflective of a progressive attitude towards securing a livelihood while the close correspondence of work preference to work history for the Venda is indicative of a certain measure of conservatism[1]. For purposes of the discussion, Venda attitudes towards mining experience will be singled out as an indication of the possibly detrimental effect which traditional culture may have on cognitive adaptability.

It was concluded that through mining experience, and the exposure to western technological society which accompanies it, the Pedi rural sample were more differentiated in terms of their mental abilities than were the rural Venda sample. This would place the Pedi at an advantage over the Venda in later adaptation to other circumstances carrying western technological demands, (e.g. secondary industry employment). The Pedi, although not chosing mining as the preferred work they would like to do, did not baulk at the idea of mine employment when none other form of wage-earning was available. The Venda however have advanced a variety of reasons for not wanting to take up mining experience. Among these are: fear of death underground and alarm at reports of tragedies on the mines; the absence of recruiting offices in their areas ; and not wishing to go to the mines because they would not work at a place where there are no Vendas anyway and so on. It is the author's suspicion that the above reasons could be either rationalizations for something more deep-seated than fear of death or anxiety at working in the company of strangers, or results of a vicious circle which over the decades has made it increasingly difficult for Vendas to take up mining employment voluntarily. On the question of rationalization, it might

[1] D.R. Mugudamane, personal communication.

..../80

be pointed out, by way of a suggestion that fear of going underground could be related to the fact that many Vendas believe that their ancestors inhabit the bowels of the earth. Pedis do not share such a belief. However when questioned on this possibility, Vendas admit that the likelihood of meeting an ancestral spirit does not consciously motivate their avoidance of mining jobs. A second suggestion might be that avoidance of mining serves the function of symbolizing Venda-Shangaan differences. Many Vendas point out that mining is a "Shangaan occupation" and is therefore to be looked down on. Transvaal Shangaans live interspersed with the Venda in large numbers and are seen by the latter as an "inferior tribe". Of course, it is the Mozambique Shangaan rather than his Transvaal cousin who takes readily to mining, for recruiting facilities for Shangaans in Vendaland would also not exist.

At any rate, whether Venda avoidance of mining employment be the result of such factors as fear of death on the one hand or the belief that it is an "inferior" job on the other hand, or even a rationalization for a more deep-seated reason which few Vendas are either willing or are able to divulge, the fact seems evident that a cultural belief or attitude has hindered the exposure of individuals to an environment which otherwise could have contributed indirectly to improved cognitive adaptability to western societal demands.

In overall conclusion it seems justified empirically to assert that the Pedi sample as a whole are better equipped, mentally, for successful adaptation to the demands of western culture in South Africa than are the Venda, but with more equitable work opportunities for the two tribal groups, such differences should be reduced considerably. Furthermore, differences between tribes in terms of cognitive adaptability should become less pronounced given similar attitudes towards

..../81

employment in terms of work preferences. Traditional culture is concluded to have only an indirect effect on measures of cognitive performance which is determined by such factors as employment opportunity and preference. There seems little to support the speculation that culture in terms of traditional arts and crafts, religious beliefs, the economic structure of society and so on are active agents which influence directly a cognitive test score at least insofar as adaptation to western demands is concerned.

APPENDIX A

THE GENERAL ADAPTABILITY BATTERY

(a) Sorting Test I

The apparatus for this test consists of a wooden tray divided into 16 compartments. In each compartment a single sample item such as a washer, nail, screw, rivet or nut, is attached. Altogether there are 16 different kinds of objects which differ, if not in kind, then in size and material. A second tray, without compartments, contains five replicas of each of the sample items. Therefore there are 80 items in this second tray.

The testee is required to sort the items as rapidly as possible into their appropriate compartments. There are two trials in this test, each with a specific time limit. The testee's score is the total number of discs correctly sorted.

(b) Sorting Test II

The apparatus consists of a tray with 16 compartments. At the back of each compartment, on an inclined plane, a sample brass disc is attached. Each disc has a symbol, either a letter or a digit, or combinations of two letters or two digits, stamped in the centre of it. Altogether there are 16 different discs. A second tray, without compartments, contains five replicas of each of the sample discs. Therefore there are 80 discs in this second tray.

The testee is required to sort the items as rapidly as possible into their appropriate compartments. There are two trials in this test, each with a specific time limit. The testee's score is the total number of discs correctly sorted.

(c) Cube Construction Test

The apparatus consists of 27 cubes (2,5 cm) and four model blocks. 8 of these cubes have 3 sides painted red and the other 3 sides painted white; 12 have 2 sides painted red and the other 4 sides white ; 6 have 1 side painted red and the other 5 sides

..../2

white and one cube is painted completely white. For ease of administration these cubes are arranged in three separate compartments according to the number of sides of the cubes painted red. The model blocks simulate assemblies of 8, 12, 18 and 27.

A model block is placed in front of the testee together with the requisite number of cubes. He is required to assemble the given cubes into an exact replica of the model block, i.e. all the red sides should be outside and all the white sides inside. There are 4 trials altogether, each with a specific time limit. The first trial is not scored and errors made are pointed out to the testees. The next three trials are scored according to the number of cubes correctly positioned. Testees who have correctly assembled all the cubes receive an additional bonus point.

(d) Tripod Assembly Test

The apparatus consists of 18 metal parts which can be assembled to form a tripod with a weight suspended from it. The legs of the tripod are prevented from splaying by an assembly of links which are joined to the legs of the tripod, and a centre ring. The pieces are presented in a standard form in a wooden tray.

The testee is required to assemble the individual pieces to reproduce a tripod, after having been shown a model with some indication of the inter-relation of the parts. There are three trials in this test, each with a specific time limit. Before each trial the model is shown briefly. The score is based on the number of pieces correctly assembled and the bonus points are allocated according to correct assembly.

Form Perception Test

In this test outlines of different geometrical shapes are printed on the pages of a booklet. The outlines are symmetrical in shape and only one appears on each page. The same set of three pieces accompanies each item. The pieces are geometrical in shape and made of paper which is blackened on one side and

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gummed on the other. The smallest piece is a right-angled isosceles triangle. The middle piece, of the same shape, is a combination of two of the smaller pieces. The largest piece is a combination of three of the smaller pieces and is in the shape of a trapezium. The test contains one practice item and nine test items.

The subject has to position the three pieces within the outline and when he is satisfied that they fit, he has to stick them in position. A time limit of two minutes is imposed upon each item and it is scored by allocating one mark for each piece correctly placed.

Fret Repetition Test

This test consists of a booklet containing two practice items and ten test items. Each item is printed on a separate page. At the top of the page is a configuration of dots joined by means of continuous straight lines to form a pattern similar to those found on Greek vases. At the bottom of the page only the dots are presented. The testee is required to join these dots by means of straight lines to reproduce the model pattern. No time limit is imposed on the test but it has been found that testees require only a minute or two to reproduce the pattern. One mark is credited for each pattern correctly reproduced.

Fret Continuation Test

This test consists of a booklet containing two practice items and ten test items. Each item is printed on a separate page. It has a configuration of dots joined by means of continuous straight lines at the top of the page but an incomplete reproduction of the model pattern is presented at the bottom of the page. The testee is required to trace the given part of the pattern with a pencil and then continue it on his own until he has completed it. No time limit is imposed. Testees generally require two to three minutes for each item. One mark is credited for each pattern correctly completed.

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Pattern Reproduction Test (Modified Kohs)

This test contains one practice item and six test items. The items are printed on the pages of a booklet. Only one item appears on each page. On each page of the booklet there are two squares. The square on the left-hand side contains a complex pattern. The square on the right-hand side is the same size but is blank. The practice item and test items 1, 2 and 3 contain 76 x 76 mm squares. Test items 4, 5 and 6 contain 114 x 114 mm squares. For each item a set of tiles is given to the subject. For the practice item and the first three test items the subject receives four tiles. For the remaining test items the subject receives nine tiles. The items are arranged in an ascending order of complexity. The subject is required to assemble the tiles in the blank square in such a way that the complex pattern is reproduced.

Form Series Test

This test contains four practice items and eighteen test items. The items are printed on a sheet of durable paper which is wrapped around a plywood board. This sheet of paper is affixed to the board by means of double-coated masking tape. Each item is a sequence of symbols ; each symbol being a compound of a particular size, colour and shape. In the test, as a whole, three colours, three shapes and two sizes are drawn upon to construct the items.

Only part of a sequence is presented in each item and the testee is required to continue it by affixing two plastic forms, which he selects from a tray, to the strip of masking tape running down the side of the board. In marking the items of the test, credit is given only if both answer forms are correct in all respects i.e. the shape, colour and size of the two forms all have to be a correct continuation of the given sequence. The test is untimed.

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Symbol Series Test (S.S.T.)

This test contains four practice items and twelve test items. The items are printed on both sides of a 203 x 313 mm sheet of white cardboard.

A sequence of symbols is presented and the subject is required to continue it. He does this by drawing in, with a pencil, two symbols in the two spaces provided at the end of the sequence. In marking the test the quality of the drawings is ignored. Subjects are given credit for an item if both spaces are filled in correctly. The test is untimed.

APPENDIX B

Grid-diagram of frequency of individuals in each cell
(age x tribe x education x urbanization comparison)

Note: In some cases the totals for each I.B.P. sample do not tally with those given in previous reports for the Venda and Pedi studies. The reason for this is that in the case of the Pedi samples, all individuals who are older than 55 or who have gone beyond eight years schooling are omitted from the analysis. In the case of the Venda literate samples, all subjects with eight years education were re-introduced into the analysis, having been omitted in the Venda study. In addition, several Pedi subjects were introduced into the I.B.P. - pool who had not completed the full battery of tests used in the Pedi analysis, yet who had completed all 10 tests selected for the matched comparison study.

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Grid-diagram of frequency of individuals according to comparison of age range by tribe by education by urbanization

Age	Venda				Pedi			
	Rural		Urban		Rural		Urban	
	Illiterate	Literate	Illiterate	Literate	Illiterate	Literate	Illiterate	Literate
16-20	2	42	0	9	8	41	0	6
21-25	4	53	1	18	8	28	10	24
26-30	7	18	3	16	10	8	18	25
31-35	10	9	3	14	9	8	21	22
36-40	18	6	17	29	15	13	23	9
41-45	11	5	21	29	4	6	15	4
46-50	29	1	24	25	6	6	14	4
51-55	13	2	24	15	4	1	7	3
Total	94	136	93	154	64	111	108	97

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