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PROBLEM SOLVING STYLES OF RESEARCH SCIENTISTS

NATIONAL INSTITUTE FOR PERSONNEL RESEARCH
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NATIONAL INSTITUTE FOR PERSONNEL RESEARCH
COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

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The investigation is part of a doctoral thesis to be submitted to the University of South Africa. Promotor of the thesis is Prof. J.M. Schepers.

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1. INTRODUCTION.

This study is concerned with the identification of the intellectual requirements for research workers at the Council for Scientific and Industrial Research and forms part of a long term research programme aimed at the improvement of the validity with which research staff are selected for appointment in this organization.

Initially a qualitative-descriptive approach was used to study the characteristics of the research workers and their jobs, e.g. by means of the N.I.P.R. Job Description and Job Evaluation Method. These investigations (Osrin, 1968; Skawran, 1969(2), 1970) generated information ranging from "self-perceived mental processes" to information on job content, levels of functioning, etc, to highlight different aspects with regard to the job demands of research positions. On the basis of the results obtained more stratified selection procedures were recommended.

From a further detailed analysis of the research scientists' working procedures (Süssenguth, 1970) it became apparent that there was a need to study more closely the manner in which research workers from different disciplines and working at different levels approach their work, and how their approach is interrelated with specific intellectual abilities. In this respect it was felt that their thinking processes, and more specifically their problem solving styles, may play an important role.

Subsequently a pilot study was initiated to investigate the feasibility of measuring thinking and work habits of research scientists and to use a quantitative approach (Süssenguth, 1972).

Various theoretical as well as practical considerations led to the conclusion to apply questionnaires for self-rating. Two questionnaires were developed. The first contained bi-polar statements describing five different categories of thinking. From these categories statements on work habits were inferred, which could also be grouped into five categories and which formed the second questionnaire.

For the purpose of testing the effectiveness of the two questionnaires as measuring devices both were administered to R and D scientists (N = 144) for self-rating. Confirmatory factor analyses of both questionnaires identified the following four of the five hypothesized thinking and work habits as independent dimensions of thinking and working:

Thinking habits.

- (i) Rigorous versus Digressive Thinking;
- (ii) Versatility versus Rigidity in Thinking;
- (iii) Ideational Conformity versus Ideational Independence;
- (iv) Daydreaming versus Lack of Daydreaming.

Work habits.

- (i) Thorough versus Careless Work Performance;
- (ii) Versatile versus Rigid Work Performance;
- (iii) Dependent versus Independent Work Performance;
- (iv) Low Performance Potential versus High Performance Potential.

In three out of four cases the operational definitions of thinking and work habits show a high degree of similarity and suggest a strong relationship between thinking and work habits.

By applying item-analytical procedures, reliabilities ranging from $r_{tt} = 0,76$ to $r_{tt} = 0,90$ and higher were obtained. All but one scale met the prescribed level of acceptance, viz. a reliability of $r_{tt} = 0,80$.

On the basis of these promising results it was decided to extend the approach used in the pilot study into a more comprehensive investigation concerning the problem-solving styles of scientists. The report deals with the findings of this investigation.

2. DEFINITION OF PROBLEM - SOLVING STYLES.

The definitions of "problem - solving" depends largely on the interpretation of the different psychological schools of thought investigating this field of intellectual functioning.

Behaviourism considers "that associational laws established in comparatively simple classical and instrumental conditioning situations apply to complex human learning" such as problem solving. (Davies, 1966, p.36). A variety of models were developed to study human problem - solving as mediational processes between stimuli and responses. (Maltzman, 1960; Keudler and Keudler, 1962; Gagué, 1964; Staats and Staats, 1963).

It is however, difficult to decide which of these models merits support because they often cover quite different facets of Stimulus-Response systems, and they lack experimental evidence regarding their effectiveness in practical application.

Gestalt Psychology was the other major school which specifically investigated problem - solving. The problems themselves were given in the form of a problem situation (e.g. Maier's Two-String Problem, 1931), or as "one-item" paper and pencil tests (e.g. Duncker's Radiation Problem, 1945; Wertheimer's Parallelogram Problems, 1945). Analyses of protocols describing the subjects' behaviour in these "problem situations" were used to determine the major variables involved in the solution of a problem. Determinants of problem-solving such as "functional fixedness", "recentering of a perceptual field", "Einstellung", "productive and reproductive processes" were identified. A variety of such experiments were undertaken lately (Adamson, 1952; van der Geer, 1957; Maier, 1963) and mainly served to support models

in the Gestalt tradition. The impact of these studies was therefore only of marginal relevance to applied psychology.

As indicated in the pilot study report (Süssenguth, 1972) this investigation applies principles of differential psychology to problem-solving (See: Gaugh, 1960; Guilford, 1962; French, 1965; Ertel, 1966; Helson, 1970), because results obtained are likely to be of immediate practical value in applied psychology. Some of these earlier attempts, however, were characterized by a rather inconsistent use of the term "problem - solving".

In approaching the definition of "problem - solving styles" this study emphasizes the process characteristics of intellectual functioning, i.e. the manner with which people utilize their abilities to cope with their environment. In this respect, the approach taken is very similar to Witkin's investigation of "cognitive styles" (Witkin, 1948, 1950, 1962). Witkin inferred "perceptual styles" from the performance on different tasks (e.g. Rod and Frame Test, Embedded Figures Test, Tilting Room - Tilting Chair Test). They were extended as "cognitive styles" by interrelating the former with other aspects of psychological and intellectual functioning. Both perceptual and cognitive styles are assumed to be relatively stable and consistent. Compared to Witkin's approach, however, this investigation is based on an approach where the thinking processes are analysed by means of self-ratings. The thinking processes are therefore not inferred from individual differences found in test performance.

Since both the Gestalt and the Behaviourist schools used the term "human problem solving" within the context of their investigations concerning the process characteristics of intellectual functioning, there was sufficient reason to retain this term for our investigations as well. This was done to avoid unnecessary

confusion regarding the terminology used.

With regard to the term "style" used in this study, it was felt that it describes more adequately those (thinking) processes which possess collective and relatively stable characteristics and as such account for certain consistencies in behaviour. The term "style" should not, however, be confused with the concept "strategy". Most investigations concerned with the study of strategies in problem-solving and/or concept attainment (Bruner, Goodnow, Austin, 1956; Restle, 1962; Schepers, 1971) imply that a "strategy" refers "to a pattern of decision-making" (Bruner et al., 1955), where a logical sequence of steps is taken to ensure the attainment of set objectives. In this respect the "style" concept does not imply decision-making nor logical operation, but thinking processes with collective characteristics identified as "thinking habits" in the pilot investigation.

It is on the basis of these thinking habits that the extended concept of problem - solving styles was developed. Similar to Witkin's cognitive styles, this concept is assumed to comprise attitudes, habits, traits and cognition. Consequently, the nature of these and their interrelations have still to be determined. Our concept of problem-solving styles represents an integrated part of a person's functioning, rather than a specific and isolated variable of intellect.

To conclude, problem - solving styles therefore can be defined as groups of thinking processes with collective characteristics which are:

- (a) relatively enduring and recurrent, thus representing consistencies of the manner in which an individual copes with his environment.

- (b) interrelated with attitudes, habits, traits and abilities, where the nature of these and the extent of their interrelationship has still to be determined.

3. PURPOSE OF THE STUDY.

Within the context of the long term research programme (aimed at the improvement of the selection procedures for research staff) it is the purpose of this investigation to identify individual differences in problem-solving styles of C.S.I.R. research workers. This implies the study of the interrelationship between the thinking habits of the research scientists (as identified in the pilot investigation) and their work habits, as well as their measured personality traits and intellectual abilities. In addition, factor analytical procedures will be applied to the data obtained to determine the extent to which problem-solving styles represent consistencies in behaviour and influence intellectual performance as measured by cognitive tests.

4. EXPERIMENTAL DESIGN.

The planning of the experimental design for this study took account of a simultaneous study on the intellectual structure of C.S.I.R. scientists undertaken by Verster (1972). The sampling requirements in this study coincided with those of the present investigation.

4.1 SAMPLE.

The sample addressed in both studies consisted of 200 research scientists employed at the C.S.I.R. The sample was drawn by obtaining a list of the total C.S.I.R. population ordered according to rank and institute. Every third name on the list was excluded, resulting in a two-thirds sample giving a proportionate representation of rank and institute.

The first testing session, with the total sample ($N = 200$), lasted five hours and was conducted by J.M. Verster. This session involved the measurement of various intellectual abilities, in the first place of relevance to the development of a deductive reasoning test (Verster, 1972) but also of relevance to this study in establishing the interrelationship between thinking habits, etc., and cognitive functioning.

The results of the first group testing indicated that subjects whose home language was neither English nor Afrikaans experienced difficulties in following the test instructions and in doing some of the tests. Since language also played a pronounced role in the subsequent testing

session, particularly with regard to tests which contained language items, these people (and those who did not complete all the tests of the first session) were excluded from the sample. The final sample size on which the analyses were based in the first study was 160. Of these, 146 persons were tested by the author in the second testing session, which lasted four to five hours.

All subjects had at least one years experience in research and devoted more than 60% of their time to research activities.

Participation in the study was not entirely voluntary. Superiors asked their subordinates to take part in the investigation. The general co-operation was very good. There were cases, however, where strong resistance against testing was encountered. Such cases were fortunately rare and were also excluded from the investigation.

The analysis of the results of the first testing session (Verster, 1972) had also indicated that separate statistical treatment of English and Afrikaans speaking subjects was necessary. In view of these results and other evidence indicating differences between Afrikaans and English speaking subjects (Biesheuvel, 1959) it was decided to perform separate statistical analyses for both groups for all the test results obtained. Of the 146 research workers who completed all the tests, 82 were English speaking and 64 Afrikaans speaking. Further characteristics of both samples as well as the total group are provided in tables 1 to 5.

TABLE 1.

AGE DISTRIBUTION.

	Age Range	M	S.D.
Total	22 - 59	29,9	6,4
English	22 - 59	29,2	6,1
Afrikaans	23 - 56	30,2	6,8

TABLE 2.

YEARS OF RESEARCH EXPERIENCE.

	Range of experience	M	S.D.
Total	1 - 20	5,2	4,3
English	1 - 20	5,0	4,2
Afrikaans	1 - 18	5,5	4,5

TABLE 3

RANKS.

	ARO	RO	SRO	CRO	SCRO
Total	28	51	48	17	2
English	21	24	27	9	1
Afrikaans	7	27	21	8	1

TABLE 4

DEGREES.

	B.Sc.	B.Sc. Hons.	M.Sc.	PhD
Total	57	23	45	21
English	38	12	21	10
Afrikaans	19	11	24	11

TABLE 5

SUBJECTS.

	Engineering	Physics	Chem.	Maths.	Others (Biol., Zool.)
Total	65	18	26	10	27
English	35	12	13	4	15
Afrikaans	30	6	13	6	12

As in the pilot investigation a variety of research fields, age groups, etc., were included in the investigation. This was desirable in view of the underlying principle of the study, viz. to identify problem-solving styles which remain constant and independent of different situations and individuals.

4.2 TEST MATERIAL.

The guiding principle for the selection of a suitable test battery for the study was to obtain and apply measuring devices which logically could be assumed to be of relevance to the thinking and work habits as identified in the pilot investigation. It was assumed, for example, that an individual scoring high on the dimension "Variability in Thinking" and "Versatile Work Performance" will also score highly on tests of divergent thinking. Consequently some of Guilford's tests of divergent thinking (viz. Seeing Faults, Consequences, etc.) which were modified by Shapiro (1968) and Schmidt (1972) were included in the study. This rather subjective procedure can be justified in view of the large number of tests included in the study.

The selection of tests was also influenced by the demands of Verster's (1972) investigation on the development of a deductive reasoning test. All the tests used for the purpose of the present study can be grouped into three categories, viz. the author's scales, cognitive tests and personality tests.

4.2.1 SCALES : THINKING AND WORK HABITS.

The items measuring thinking and work habits were randomly compiled in the previously developed test format. (See Appendix A and B). For the dimension "High versus Low Work Potential" an additional 10 items were constructed (See Appendix C) and included in Questionnaire B on Work Habits in order to increase the reliability of this scale.

The questionnaire scales used were the following:

Questionnaire A : Thinking Habits.

- Scale No 1 : (Rigorous versus Digressive Thinking)
16 items.
- Scale No 2 : (Versatility versus Rigidity in Thinking)
16 items.
- Scale No 3 : (Ideational Conformity versus Ideational Independence) 15 items.
- Scale No 4 : (Daydreaming versus Lack of Daydreaming)
13 items.

Questionnaire B : Work Habits.

- Scale No 1 : (Thorough versus Careless Work Performance)
23 items.
- Scale No 2 : (Versatile versus Rigid Work Performance)
25 items.
- Scale No 3 : (Independent versus Dependent Work Performance)
15 items.
- Scale No 4 : (Low Performance Potential versus High Performance Potential) 21 items.

Rating of the items took approximately 30 to 40 minutes for each Questionnaire. For each scale one total score was obtained by adding the rating points of all items. The items themselves were scored by a 9 - point scoring key which was applied in accordance with the directions of the scale.

4.2.2 COGNITIVE TESTS.

4.2.2.1 FIRST TEST SESSION.

The cognitive tests used for this investigation were the same as used in Verster's study on deductive reasoning and therefore are not described here in detail. In the context of this study their hypothetical as well as their actual factor loadings, (as identified by Verster) are mentioned for our purposes. The same applies to the testing time used and the number of items.

TABLE 6.

TEST	TIME (Mins)	No. OF ITEMS	HYPOTHESIZED FACTORS	IDENTIFIED FACTORS
(i) Locations	14	28	Induction	Reasoning
(ii) Deductive Reasoning	40	45	Deduction	Reasoning
(iii) Card Rotation	12	28	Space	Space
(iv) Letter Sets	16	30	Induction	Reasoning
(v) Inference	14	20	Deduction	Reasoning
(vi) Cube Comparison	10	42	Space	Space
(vii) Figure Classification	18	224	Induction	Reasoning
(viii) Blox	30	45	Space	Space
(ix) Reasoning Ability	30	30	Deduction	Reasoning
(x) Pattern Completion	10	30	Induction	Reasoning
(xi) Figure Series	10	30	Deduction	Reasoning

4.2.2.2

SECOND TEST SESSION.

In addition, the following cognitive tests were applied in the second testing session:

(i) Gottschaldt Figures.

This test represents an N.I.P.R. adaptation of the original Gottschaldt Figures Test. It contains forty-five complex geometric designs accompanied by five simple key figures. The subject decides which of them is incorporated in the geometric design and marks his answers on an answer sheet. Test time is 20 minutes. The reliability of this test is $r_{tt} = 0,86$.

The Gottschaldt Figures test is very similar to Witkin's et.al. (1950,1962) "Embedded Figures Test" and is considered as one of the measures of field-dependence/independence. Dubois and Cohen (1970) however, found that it can be also related to cognitive ability variables. According to French (1963) major components of this test consist of perceptual speed, visualization and speed of closure.

(ii) Common Elements Test.

This test was developed by Schmidt (1970). It contained 9 simple figures across the top of each page. Twenty-five pairs of complex figures (items) are listed below them, each containing at least one of the elements, being geometrically similar to those on top of the page, i.e. in terms of their shape but not necessarily with regard to their size. The subject

has to establish which of the key faigures are common to both of the items and has to mark his answer accordingly.

Test time is 50 minutes. The test is considered as a measure of "visual creativity" (Schmidt, 1970) and correlates highly with measures of divergent thinking.

(iii) Seeing Faults Test.

The test was developed by Shapiro (1968) and modified by Schmidt (1970). It consists of three parts, each with a time limit of 5 minutes. Each part contains the description of a solution to a particular problem. Subjects are required to name all the weaknesses in the proposed solution to the problem. A score is given by adding the number of acceptable faults described.

Test time is 15 minutes. The test represents divergent thinking and measures sensitivity to problems (French, et.al., 1963) and/or "creativity" (Shapiro, 1968).

(iv) Consequences Test.

The test was also developed by Shapiro (1968) and modified by Schmidt (1972). It consists of three parts, each with a time limit of 5 minutes. Each part consists of a description of an unlikely situation. Subjects are required to name all possible consequences arising from these hypothetical situations. A score is obtained

by adding all acceptable answers.

Test time is 15 minutes. As scored by Shapiro (1968) the test measures "originality" or "a general factor of creativity". Applying Schmidt's (1972) new scoring scheme, it appears to be more clearly a measure of fluency.

(v) Qualities Test Colour and Shape.

Both tests were developed by Shapiro (1968). Subjects are asked to write down the names of as many things they can remember which were white and pointed in shape. Scores are obtained by adding the number of acceptable answers. Both tests were scored separately by Shapiro. In this study a total score was obtained from both tests in order to increase the stability of the instrument.

Test time for each of the tests is 5 minutes. Similar tests used by Guilford (1959) measure ideational fluency. In Shapiro's investigation both tests loaded relatively high on "a general factor of creativity and a small group factor".

4.2.3 PERSONALITY TESTS.

(i) The Meyers-Briggs Type Indicator (MBT).

The test consists of 166 forced-choice items designed for use with normal subjects. Subjects' self-ratings are assumed to indicate his preference for four dichotomous personality dimensions, as follows:

(a) Judgement-Perception.

This dimension refers to a preference for adopting a judgemental and critical attitude towards the environment, or as opposed to a preference for an understanding/perceptive attitude.

(b) Thinking - Feeling.

This measure determines whether a person prefers to take decisions by "objective" logical processes or by subjective evaluations.

(c) Sensation - Intuition.

This dimension refers to a realistic, practical and conventional attitude as opposed to one which is more imaginative, i.e. where people follow their intuition in solving new problems.

(d) Extraversion - Introversion.

This dimension describes the direction of activities towards the outside world versus directing the thoughts inwards upon oneself.

The test takes approximately 50 minutes to complete and the Reliabilities for the four dichotomous dimensions range between 0,80 and 0,87 for a group of male college students, where the Thinking - Feeling dimension is slightly less reliable than the other scales. (See : Briggs-Myers, 1970).

Scoring the test in the prescribed manner, preference scores for the four dimensions are obtained. However, by applying a specific formula, the person's "type" (according to Jung's typology) is determined. This treatment of the test results has been generally criticized (Mendelsohn, 1970; Sundberg, 1970) and experimental data so far seems to indicate that there is little evidence for Myers-Briggs' assumptions on the very complex interaction of the scales. (See : Stricker and Ross, 1964). In this investigation the usually supplied scoring keys were used to determine the raw scores for the polarities of each dimension separately (e.g. seperately for introversion and extroversion). In this manner each "scale" is regarded as a trait continuum. This procedure is also more acceptable to the reviewers of the test.

(ii) N.I.P.R. Temperament - Questionnaire.

This questionnaire contains 27 items each consisting of two statements describing behaviour characteristics. The subjects choose one of the two statements as being more like themselves.

The test can be completed within 10 minutes. It purports to measure primary functioning (people who express emotions readily, are easily stimulated, prefer mobility and variability, etc.) versus secondary functioning (over-cautious people, who become fixed to a few ideas, etc.). The concept of primary-secondary functioning was developed by Heymans (1908) and followed up by Biesheuvel (1949). The test correlates highly with a measure of extroversion-introversion (See : Retief, 1969).

Except for the two Thinking and Work Habit Questionnaires and the Myers-Briggs Type Indicator, all other tests were available in English and Afrikaans. As already discussed in the pilot study report the influence of language on non-cognitive tests could be neglected, bearing in mind that all subjects were sufficiently bilingual or proficient in English. Furthermore, there were no time limits set for the questionnaires and the Myers-Briggs Type Indicator.

5. STATISTICAL ANALYSES.

5.1 GENERAL CONSIDERATIONS.

The investigation draws from two population groups - the English and Afrikaans speaking - with certain cultural differences. There exists some evidence that these differences might also have a bearing on facets of intellectual functioning (Biesheuvel and Liddicoat, 1959). Therefore most of the analyses will be performed separately for the two language groups to avoid "contamination" of the results with uncontrolled variables.

As outlined in the pilot investigation, the metrical properties of the scales measuring thinking and work habits are highly satisfactory. Since they represent relatively novel measuring instruments it is preferable to confirm their metrical properties with the present sample.

Various investigations applying factor-analytical procedures have used normalized or standard scores for the analysis of the results. In this study the raw test scores will be used for the required analyses. This will not be done, however, unless the metrical properties of the tests have been evaluated to ensure that they compare favourably with the generally accepted psychometric standards.

5.2 METHODS AND THEIR APPLICATION.

The following statistical methods were applied to process the results:

(i) An item-analysis programme, calculating the Gulliksen-Index ($r_{it} \cdot s_i$) as well as the item-total score correlations (r_{it}) for all items of the thinking and work habit scales. For all eight scales, reliabilities were calculated according to the Kuder-Richardson Formula 20.

(ii) Means, standard deviations, skewness and kurtosis coefficients were calculated for all test variables. This was done to obtain an indication as to the discriminative power and the distribution of scores in all measuring instruments.

(iii) Scores of all tests were intercorrelated and matrices of the intercorrelations were obtained. They were examined in detail to determine which of the variables were to be excluded from further analysis.

(iv) Tucker's (1958) inter-battery method of factor analysis was applied in a specific manner. Tucker developed his method to determine the stability of factors over two different samples. From these samples or test batteries only the factors common to both batteries were extracted. Tucker's method was applied twice for both the English and Afrikaans samples as follows:

(a) For the first factor analysis battery one contained personality variables and battery two thinking and work-habit scales. The common factors for both batteries were interpreted as problem-solving styles involving aspects of personality, thinking and work habits.

(b) For the second analysis battery one consisted of personality variables, thinking and work habits, whereas the second one contained the cognitive tests. With the analysis it was intended to establish the influence of problem-solving styles on achievements on cognitive tests.

6. DISCUSSION OF THE RESULTS.

6.1 THINKING AND WORK HABITS : ITEM ANALYSES.

With regard to the item-analyses no distinction was made between English and Afrikaans speaking subjects. High factor loadings and reliabilities indicated that the dimensions identified were well represented in both groups. Only when the extent of their representation and their interrelation with other variables were determined, were the analyses performed separately.

Table 7 and 8 represent the results of the item-analyses, viz. the Gullikson-Index ($r_{it.s_i}$), item-total score correlation (r_{it}) and the respective reliabilities for both questionnaires.

The general results obtained are similar to those obtained from the first item-analyses during the pilot study. All scales retained their high Gulliksen-Indices, item-total score correlations and reliabilities. As was hoped the reliability of Scale No. 4, Questionnaire B did improve. By adding another 10 items, the reliability went up from 0,769 to 0,836. The results confirm the finding that the thinking and work habits are stable with regard to research scientists. The metrical properties of the newly developed scales justify their further use in this investigation and also in the more general field of applied psychology.

TABLE 7. ITEM ANALYSES : THINKING HABITS.

SCALE No.1 (Rigorous versus Digressive Thinking)				SCALE No.2 (Versatility versus Rigidity in Thinking)			
Item Number	$r_{it \cdot s_i}$	r_{it}	KR20	Item Number	$r_{it \cdot s_i}$	r_{it}	KR20
11	1,250	0,550	$r_{tt} = 0,865$	2	1,531	0,664	$r_{tt} = 0,896$
23	1,146	0,480		8	1,474	0,635	
27	0,942	0,412		10	1,230	0,548	
29	1,482	0,611		12	1,615	0,710	
31	1,411	0,574		17	0,713	0,407	
39	1,397	0,596		20	1,301	0,542	
40	1,226	0,552		22	1,455	0,702	
43	1,127	0,616		26	0,979	0,551	
45	1,446	0,608		30	1,724	0,727	
48	1,341	0,620		34	1,329	0,536	
52	0,968	0,511		38	1,131	0,524	
53	1,544	0,669		47	1,346	0,746	
54	1,530	0,667		51	1,463	0,714	
55	1,305	0,617		57	1,308	0,723	
56	1,150	0,295		58	1,352	0,641	
59	1,331	0,240		60	1,326	0,689	

SCALE No.3 (Ideational Conformity versus Ideational Independence)				SCALE No.4 (Daydreaming versus Lack of Daydreaming)			
Item Number	$r_{it \cdot s_i}$	r_{it}	KR20	Item Number	$r_{it \cdot s_i}$	r_{it}	KR20
1	1,660	0,641	$r_{tt} = 0,802$	3	1,860	0,680	$r_{tt} = 0,920$
6	0,787	0,336		4	1,915	0,739	
13	0,859	0,429		5	1,592	0,665	
14	1,307	0,623		7	1,515	0,675	
15	1,293	0,601		9	1,663	0,678	
18	1,271	0,647		16	1,391	0,634	
21	1,045	0,497		19	1,516	0,689	
24	1,110	0,508		25	1,580	0,653	
28	0,626	0,299		37	1,743	0,799	
32	0,803	0,466		41	1,582	0,706	
33	0,706	0,339		42	1,723	0,795	
35	1,518	0,663		44	1,733	0,775	
36	1,410	0,700		49	1,823	0,852	
46	1,290	0,641					
50	0,565	0,322					

TABLE 8. ITEM ANALYSES : WORK HABITS

SCALE No.1 (Thorough versus Careless Work Performance)				SCALE No.2 (Versatile versus Rigid Work Performance)			
Item Number	$r_{it \cdot s_i}$	r_{it}	KR20	Item Number	$r_{it \cdot s_i}$	r_{it}	KR20
2	1,633	0,700	$r_{tt} = 0,904$	5	1,123	0,440	$r_{tt} = 0,867$
3	1,678	0,706		6	0,723	0,348	
4	1,627	0,672		10	1,666	0,625	
9	1,078	0,452		11	1,063	0,548	
13	1,151	0,485		12	0,825	0,396	
14	1,490	0,618		15	1,241	0,575	
17	0,744	0,441		18	1,487	0,628	
22	1,378	0,587		21	1,132	0,532	
25	1,328	0,554		24	0,968	0,446	
26	0,842	0,319		31	1,416	0,591	
27	1,026	0,434		32	1,687	0,654	
29	1,537	0,683		34	0,935	0,474	
30	1,158	0,474		38	0,778	0,350	
35	1,184	0,556		41	1,351	0,636	
39	1,511	0,665		43	1,222	0,541	
40	1,198	0,557		48	0,835	0,490	
44	1,328	0,502		50	0,859	0,375	
46	1,085	0,519		51	0,840	0,403	
53	1,255	0,602		54	0,966	0,423	
58	1,169	0,703		60	1,012	0,519	
72	1,378	0,739		62	1,081	0,518	
75	1,575	0,779		63	1,364	0,585	
77	1,179	0,493		68	1,179	0,588	
				74	0,490	0,218	
				79	0,562	0,303	

SCALE No.3 (Independent versus Dependent Work Performance)				SCALE No.4 (Low Performance Potential vers. High Performance Potential)			
Item Number	$r_{it \cdot s_i}$	r_{it}	KR20	Item Number	$r_{it \cdot s_i}$	r_{it}	KR20
8	1,115	0,579	$r_{tt} = 0,805$	1	1,240	0,567	$r_{tt} = 0,832$
16	0,646	0,390		7	0,965	0,464	
23	1,088	0,595		19	1,227	0,647	
33	0,724	0,397		20	1,152	0,540	
36	0,826	0,467		28	1,109	0,482	
45	1,266	0,617		37	0,682	0,340	
55	1,284	0,650		42	0,652	0,409	
57	0,732	0,437		47	0,830	0,360	
59	0,975	0,408		49	1,048	0,591	
66	1,395	0,689		52	1,587	0,650	
69	1,370	0,660		56	0,768	0,359	
76	0,806	0,457		61	1,175	0,568	
81	0,713	0,500		64	1,034	0,596	
82	0,774	0,462		65	1,085	0,549	
84	0,964	0,469		67	1,150	0,584	
				70	0,797	0,414	
				71	1,203	0,505	
				73	1,612	0,724	
				78	0,936	0,437	
				80	0,935	0,520	
			83	0,993	0,428		

6.2 MEANS, STANDARD DEVIATIONS, SKEWNESS AND KURTOSIS.

Further processing of test scores were done separately for the English and Afrikaans Samples.

Tables 9 and 10 present the statistical properties of the total test battery.

Two-tailed t-tests were applied to establish the significance of the differences between the English and Afrikaans speaking samples on each of the measurements. Significant differences between the samples beyond the 1 per cent level were found for the variables Deductive Reasoning, Cube Comparison, Inference, Myers-Briggs Sensing and Myers-Briggs Intuition.

Beyond the 5 per cent level, differences were found for Figure Classification, Reasoning Ability, Figure Series, Myers-Briggs Thinking and Myers-Briggs Feeling.

Otherwise, skewness and kurtosis coefficients indicated a fairly normal distribution for all test scores. Consequently, the raw scores of all tests were used for further analysis.

6.3 INTERCORRELATIONS.

The following numbering was used for the variables as they appear in the correlation matrices:

TABLE 11

Variable No.	Description.
1.	Locations.
2.	Deductive Reasoning Test.
3.	Card Rotation.
4.	Letter Set.
5.	Inference.
6.	Cube Comparison.
7.	Figure Classification.
8.	Blox.
9.	Reasoning Ability.
10.	Pattern Completion.
11.	Figure Series.
12.	Age.
13.	Common Elements.
14.	Gottschaldt.
15.	Seeing Faults.
16.	Consequences.
17.	Temperament.
18.	MB - Extroversion.
19.	MB - Introversion.
20.	MB - Sensing.
21.	MB - Intuition.
22.	MB - Thinking.
23.	MB - Feeling.
24.	MB - Judging.
25.	MB - Perception.

Table 11 continued.../

Variable No.	Description.
26.	Qualities Test.
27.	Scale No. 1. Rigorous vs. Digressive Thinking.
28.	Versatility vs. Rigidity in Thinking.
29.	Ideational Conformity vs. Ideational Independence.
30.	Daydreaming vs. Lack of Daydreaming.
31.	Thorough vs. Careless Work Performance.
32.	Versatile vs. Rigid Work Performance.
33.	Independent vs. Dependent Work Performance.
34.	Low Performance Potential vs. High Performance Potential.

The fact that high negative correlations were found is due to the dichotomous nature of many items. For interpretation purposes their signs can be reversed by reflecting the direction of the items.

Some high correlations in both matrices are particularly noticeable between the cognitive tests. Correlations between these and the personality variables are relatively low. A high degree of interrelation appears

TABLE 9.

MEANS, STANDARD DEVIATIONS, SKEWNESS

AND KURTOSIS COEFFICIENTS.

(AFRIKAANS SPEAKING)

VARIABLE	MEAN	S. D.	SKEWNESS	KURTOSIS	RELIABILITY
1. Locations	7,719	2,548	-0,281	-0,097	0,590
2. Deductive Reasoning ...	29,813	7,950	-0,463	-0,203	0,865
3. Card Rotation	19,984	4,796	-0,167	-0,709	0,769
4. Letter Set	22,016	4,256	-0,302	-0,695	0,685
5. Inference	12,156	2,852	-0,604	0,579	0,533
6. Cube Comparison	30,562	7,359	-0,727	0,663	0,853
7. Figure Classification .	129,562	30,381	0,387	-0,204	0,954
8. Blox	33,875	4,891	-0,365	0,679	0,643
9. Reasoning Ability	11,328	3,071	-0,850	-0,104	0,637
10. Pattern Completion	17,500	6,231	-0,134	-0,395	0,853
11. Figure Series	20,188	5,089	-0,430	-0,361	0,780
12. Common Elements	23,516	6,698	-0,246	-0,208	0,801
13. Gottschaldt	29,406	8,387	0,117	-0,882	0,878
14. Seeing Faults	16,734	4,857	0,630	0,202	0,511
15. Consequences	24,750	7,235	0,259	0,207	0,608
16. Temperament	10,641	5,094	-0,026	-0,162	0,802
17. MB - Extroversion	9,094	5,359	0,560	0,256	0,727
18. MB - Introversion	16,891	6,069	-0,497	-0,043	0,780
19. MB - Sensing	14,344	7,273	0,249	-0,824	0,830
20. MB - Intuition	10,312	5,356	0,376	-0,266	0,731
21. MB - Thinking	13,656	4,932	-0,126	-0,706	0,804
22. MB - Feeling	6,391	4,750	1,000	1,077	0,663
23. MB - Judging	16,016	6,909	-0,053	-0,844	0,869
24. MB - Perception	10,781	6,415	0,408	-0,261	0,857
25. Qualities Test	37,297	9,555	0,686	0,474	0,447
26. Rigorous versus Digressive Thinking ..	67,922	22,013	0,234	-0,233	0,865+
27. Versatility versus Rigidity in Thinking .	65,766	23,421	0,371	-0,462	0,896+
28. Ideational Conformity vers. Ideational Independence	67,891	15,900	0,227	-0,592	0,802+
29. Daydreaming vers. Lack of Daydreaming	63,125	22,226	-0,022	-0,442	0,920+
30. Thorough vers. Careless Work Performance	110,937	30,513	-0,165	-0,255	0,904+
31. Versatile vers. Rigid Work Performance	113,781	26,075	-0,190	-0,089	0,867+
32. Independent versus Dependent Work Performance	80,312	14,804	0,038	-0,651	0,805+
33. Low Performance Potential versus High Performance Potential	126,844	21,317	-0,462	-0,047	0,832+

+ Combined sample

TABLE 10.

MEANS, STANDARD DEVIATIONS, SKEWNESS
AND KURTOSIS COEFFICIENTS.

(ENGLISH SPEAKING)

VARIABLE	MEAN	S. D.	SKEWNESS	KURTOSIS	RELIABILITY
1. Locations	8,083	2,397	-0,588	0,885	0,537
2. Deductive Reasoning ..	33,707	8,074	-0,900	0,282	0,869
3. Card Rotation	21,122	4,676	-0,565	-0,560	0,757
4. Letter Set	23,195	3,598	-0,226	0,104	0,560
5. Inference	16,963	1,869	-0,969	0,905	0,51 *
6. Cube Comparison	33,561	6,260	-1,169	1,241	0,796
7. Figure Classification.	142,732	32,779	-0,280	-0,301	0,960
8. Blox	35,207	4,091	-0,113	-0,309	0,489
9. Reasoning Ability	12,317	2,479	-0,608	0,517	0,443
10. Pattern Completion ...	18,732	5,961	-0,075	-0,699	0,840
11. Figure Series	22,000	5,411	-0,795	-0,133	0,805
12. Common Elements	24,512	7,816	-0,606	-0,368	0,854
13. Gottschaldt	29,183	9,298	-0,121	-0,758	0,901
14. Seeing Faults	17,756	5,766	0,594	0,003	0,746
15. Consequences	26,427	8,325	0,470	0,247	0,660
16. Temperament	12,256	5,619	0,260	-0,175	0,838
17. MB - Extroversion	9,610	5,669	0,672	0,153	0,800
18. MB - Introversion	16,378	6,610	-0,333	-0,775	0,740
19. MB - Sensing	10,122	7,053	0,776	0,050	0,869
20. MB - Intuition	13,659	6,021	-0,163	-0,772	0,826
21. MB - Thinking	11,720	5,761	0,031	-0,754	0,826
22. MB - Feeling	8,195	6,169	0,581	-0,663	0,853
23. MB - Judging	15,610	7,335	-0,421	-0,651	0,857
24. MB - Perception	11,744	7,314	0,521	-0,671	0,831
25. Qualities Test	40,098	11,223	0,436	-0,112	0,714
26. Rigorous versus Digressive Thinking .	67,061	19,653	-0,105	-0,195	0,865+
27. Versatility versus Rigidity in Thinking .	62,829	19,718	0,325	-0,063	0,896+
28. Ideational Conformity versus Ideational Independence	63,646	16,487	0,073	-0,206	0,802+
29. Daydreaming versus Lack of Daydreaming ..	61,963	21,180	0,236	-0,334	0,920+
30. Thorough vers. Careless Work Performance	108,671	28,816	0,036	0,003	0,904+
31. Versatile vers. Rigid Work Performance	108,280	27,427	0,109	0,199	0,867+
32. Independent versus Dependent Work Performance	81,195	14,749	-0,043	-0,459	0,805+
33. Low Performance Potential versus High Performance Potential	129,951	20,482	-0,470	0,908	0,832+

* Versner, 1972

+ Combined sample

TABLE 12

INTERCORRELATION MATRIX (ENGLISH SPEAKING)

VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34													
1	100																																														
2	<u>35</u>	100																																													
3	<u>33</u>	<u>35</u>	100																																												
4	<u>34</u>	<u>40</u>	<u>38</u>	100																																											
5	<u>19</u>	<u>21</u>	<u>12</u>	<u>29</u>	100																																										
6	<u>19</u>	<u>29</u>	<u>45</u>	<u>15</u>	<u>08</u>	100																																									
7	<u>25</u>	<u>56</u>	<u>43</u>	<u>38</u>	<u>11</u>	<u>43</u>	100																																								
8	<u>28</u>	<u>37</u>	<u>45</u>	<u>47</u>	<u>-01</u>	<u>44</u>	<u>50</u>	100																																							
9	<u>37</u>	<u>35</u>	<u>13</u>	<u>34</u>	<u>29</u>	<u>18</u>	<u>22</u>	<u>30</u>	100																																						
10	<u>42</u>	<u>31</u>	<u>31</u>	<u>42</u>	<u>21</u>	<u>25</u>	<u>34</u>	<u>43</u>	<u>33</u>	100																																					
11	<u>20</u>	<u>22</u>	<u>38</u>	<u>24</u>	<u>13</u>	<u>21</u>	<u>31</u>	<u>34</u>	<u>01</u>	<u>60</u>	100																																				
12	<u>-28</u>	<u>-14</u>	<u>-01</u>	<u>-13</u>	<u>-17</u>	<u>-02</u>	<u>-05</u>	<u>-11</u>	<u>-22</u>	<u>-41</u>	<u>-20</u>	100																																			
13	<u>38</u>	<u>17</u>	<u>21</u>	<u>32</u>	<u>06</u>	<u>-05</u>	<u>20</u>	<u>12</u>	<u>18</u>	<u>28</u>	<u>23</u>	<u>05</u>	100																																		
14	<u>28</u>	<u>14</u>	<u>26</u>	<u>23</u>	<u>09</u>	<u>22</u>	<u>03</u>	<u>24</u>	<u>05</u>	<u>33</u>	<u>41</u>	<u>-21</u>	<u>37</u>	100																																	
15	<u>-06</u>	<u>07</u>	<u>08</u>	<u>06</u>	<u>-04</u>	<u>17</u>	<u>21</u>	<u>-01</u>	<u>05</u>	<u>-07</u>	<u>-10</u>	<u>06</u>	<u>16</u>	<u>02</u>	100																																
16	<u>-08</u>	<u>09</u>	<u>-09</u>	<u>06</u>	<u>-01</u>	<u>03</u>	<u>16</u>	<u>-01</u>	<u>08</u>	<u>06</u>	<u>00</u>	<u>04</u>	<u>01</u>	<u>-11</u>	<u>62</u>	100																															
17	<u>-32</u>	<u>-10</u>	<u>-15</u>	<u>-17</u>	<u>15</u>	<u>-03</u>	<u>02</u>	<u>-12</u>	<u>-06</u>	<u>-21</u>	<u>02</u>	<u>05</u>	<u>-20</u>	<u>-11</u>	<u>16</u>	<u>11</u>	100																														
18	<u>-30</u>	<u>-22</u>	<u>-12</u>	<u>-34</u>	<u>02</u>	<u>-04</u>	<u>-05</u>	<u>-16</u>	<u>-15</u>	<u>-26</u>	<u>-06</u>	<u>25</u>	<u>-17</u>	<u>-27</u>	<u>12</u>	<u>13</u>	<u>59</u>	100																													
19	<u>29</u>	<u>20</u>	<u>09</u>	<u>32</u>	<u>-03</u>	<u>01</u>	<u>08</u>	<u>18</u>	<u>17</u>	<u>24</u>	<u>02</u>	<u>-22</u>	<u>22</u>	<u>20</u>	<u>-11</u>	<u>-12</u>	<u>-60</u>	<u>-88</u>	100																												
20	<u>-18</u>	<u>-06</u>	<u>-06</u>	<u>06</u>	<u>-10</u>	<u>-05</u>	<u>00</u>	<u>17</u>	<u>02</u>	<u>-02</u>	<u>00</u>	<u>21</u>	<u>-08</u>	<u>-20</u>	<u>-20</u>	<u>-15</u>	<u>-23</u>	<u>04</u>	<u>09</u>	100																											
21	<u>10</u>	<u>08</u>	<u>-02</u>	<u>-00</u>	<u>15</u>	<u>-07</u>	<u>-04</u>	<u>-12</u>	<u>04</u>	<u>-03</u>	<u>-06</u>	<u>-19</u>	<u>05</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>16</u>	<u>-05</u>	<u>05</u>	<u>-85</u>	100																										
22	<u>02</u>	<u>-06</u>	<u>-18</u>	<u>-08</u>	<u>-08</u>	<u>14</u>	<u>-10</u>	<u>03</u>	<u>13</u>	<u>08</u>	<u>-05</u>	<u>14</u>	<u>11</u>	<u>08</u>	<u>-07</u>	<u>-01</u>	<u>-03</u>	<u>-05</u>	<u>-00</u>	<u>-06</u>	<u>01</u>	100																									
23	<u>-06</u>	<u>03</u>	<u>05</u>	<u>06</u>	<u>04</u>	<u>-20</u>	<u>08</u>	<u>-17</u>	<u>-12</u>	<u>-12</u>	<u>-02</u>	<u>-05</u>	<u>-08</u>	<u>-14</u>	<u>07</u>	<u>05</u>	<u>03</u>	<u>01</u>	<u>09</u>	<u>08</u>	<u>03</u>	<u>-87</u>	100																								
24	<u>-05</u>	<u>-13</u>	<u>-21</u>	<u>-15</u>	<u>-21</u>	<u>-17</u>	<u>-25</u>	<u>-08</u>	<u>-24</u>	<u>-10</u>	<u>-22</u>	<u>06</u>	<u>05</u>	<u>-10</u>	<u>-11</u>	<u>02</u>	<u>-23</u>	<u>02</u>	<u>06</u>	<u>31</u>	<u>-29</u>	<u>22</u>	<u>-24</u>	100																							
25	<u>04</u>	<u>13</u>	<u>21</u>	<u>11</u>	<u>21</u>	<u>17</u>	<u>28</u>	<u>02</u>	<u>26</u>	<u>12</u>	<u>14</u>	<u>-08</u>	<u>-02</u>	<u>06</u>	<u>10</u>	<u>-06</u>	<u>22</u>	<u>-03</u>	<u>-01</u>	<u>-34</u>	<u>36</u>	<u>-24</u>	<u>29</u>	<u>-94</u>	100																						
26	<u>-16</u>	<u>-22</u>	<u>-11</u>	<u>-04</u>	<u>17</u>	<u>05</u>	<u>-03</u>	<u>-12</u>	<u>01</u>	<u>-04</u>	<u>-07</u>	<u>14</u>	<u>13</u>	<u>-07</u>	<u>49</u>	<u>51</u>	<u>24</u>	<u>21</u>	<u>-11</u>	<u>-03</u>	<u>06</u>	<u>09</u>	<u>-06</u>	<u>02</u>	<u>-03</u>	100																					
27	<u>-16</u>	<u>-15</u>	<u>-12</u>	<u>-07</u>	<u>05</u>	<u>-13</u>	<u>-03</u>	<u>-09</u>	<u>-06</u>	<u>-23</u>	<u>-14</u>	<u>-03</u>	<u>-00</u>	<u>-07</u>	<u>20</u>	<u>10</u>	<u>10</u>	<u>06</u>	<u>-04</u>	<u>-07</u>	<u>19</u>	<u>-28</u>	<u>34</u>	<u>-26</u>	<u>28</u>	<u>07</u>	100																				
28	<u>05</u>	<u>-13</u>	<u>-29</u>	<u>-14</u>	<u>-15</u>	<u>-25</u>	<u>-11</u>	<u>-11</u>	<u>-11</u>	<u>-08</u>	<u>05</u>	<u>-02</u>	<u>-08</u>	<u>-13</u>	<u>-17</u>	<u>-18</u>	<u>-23</u>	<u>-03</u>	<u>10</u>	<u>22</u>	<u>-15</u>	<u>-17</u>	<u>21</u>	<u>-02</u>	<u>02</u>	<u>-10</u>	<u>29</u>	100																			
29	<u>08</u>	<u>-16</u>	<u>-02</u>	<u>-11</u>	<u>-16</u>	<u>21</u>	<u>01</u>	<u>07</u>	<u>-11</u>	<u>07</u>	<u>06</u>	<u>01</u>	<u>-06</u>	<u>-10</u>	<u>-12</u>	<u>14</u>	<u>-21</u>	<u>09</u>	<u>-12</u>	<u>06</u>	<u>-11</u>	<u>26</u>	<u>-27</u>	<u>10</u>	<u>-14</u>	<u>10</u>	<u>-13</u>	<u>09</u>	100																		
30	<u>-05</u>	<u>-09</u>	<u>04</u>	<u>15</u>	<u>-02</u>	<u>-05</u>	<u>01</u>	<u>-00</u>	<u>02</u>	<u>07</u>	<u>01</u>	<u>-03</u>	<u>01</u>	<u>09</u>	<u>-10</u>	<u>-09</u>	<u>-21</u>	<u>-22</u>	<u>10</u>	<u>29</u>	<u>-37</u>	<u>22</u>	<u>-27</u>	<u>10</u>	<u>-12</u>	<u>-03</u>	<u>-26</u>	<u>-02</u>	<u>25</u>	100																	
31	<u>-05</u>	<u>10</u>	<u>23</u>	<u>19</u>	<u>30</u>	<u>15</u>	<u>16</u>	<u>09</u>	<u>23</u>	<u>04</u>	<u>07</u>	<u>-04</u>	<u>-02</u>	<u>09</u>	<u>14</u>	<u>03</u>	<u>17</u>	<u>-03</u>	<u>-02</u>	<u>-21</u>	<u>32</u>	<u>-17</u>	<u>23</u>	<u>-63</u>	<u>64</u>	<u>-01</u>	<u>57</u>	<u>-12</u>	<u>-30</u>	<u>-13</u>	100																
32	<u>13</u>	<u>-04</u>	<u>-18</u>	<u>-10</u>	<u>-03</u>	<u>-21</u>	<u>-09</u>	<u>-08</u>	<u>-19</u>	<u>-08</u>	<u>-09</u>	<u>-03</u>	<u>-06</u>	<u>-07</u>	<u>-26</u>	<u>-20</u>	<u>-44</u>	<u>-21</u>	<u>18</u>	<u>16</u>	<u>-15</u>	<u>02</u>	<u>01</u>	<u>11</u>	<u>-17</u>	<u>-23</u>	<u>15</u>	<u>54</u>	<u>23</u>	<u>15</u>	<u>-18</u>	100															
33	<u>-21</u>	<u>15</u>	<u>-13</u>	<u>-08</u>	<u>05</u>	<u>-10</u>	<u>06</u>	<u>-05</u>	<u>-14</u>	<u>-11</u>	<u>-02</u>	<u>-08</u>	<u>-14</u>	<u>-05</u>	<u>-01</u>	<u>03</u>	<u>10</u>	<u>17</u>	<u>-07</u>	<u>11</u>	<u>06</u>	<u>-25</u>	<u>24</u>	<u>03</u>	<u>02</u>	<u>-10</u>	<u>29</u>	<u>21</u>	<u>-49</u>	<u>-21</u>	<u>15</u>	<u>17</u>	100														
34	<u>01</u>	<u>02</u>	<u>19</u>	<u>09</u>	<u>-09</u>	<u>08</u>	<u>03</u>	<u>01</u>	<u>-09</u>	<u>12</u>	<u>05</u>	<u>03</u>	<u>11</u>	<u>10</u>	<u>-01</u>	<u>05</u>	<u>-10</u>	<u>-16</u>	<u>03</u>	<u>-05</u>	<u>-10</u>	<u>28</u>	<u>-42</u>	<u>26</u>	<u>-27</u>	<u>02</u>	<u>-69</u>	<u>-46</u>	<u>14</u>	<u>36</u>	<u>-48</u>	<u>-21</u>	<u>-33</u>	100													

Decimal point omitted.

Underlined values are significant at the 5% level.

TABLE 13
INTERCORRELATION MATRIX (AFRIKAANS SPEAKING)

VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
1	100																																						
2	<u>53</u>	100																																					
3	<u>49</u>	<u>38</u>	100																																				
4	<u>52</u>	<u>44</u>	<u>34</u>	100																																			
5	<u>43</u>	<u>47</u>	19	<u>49</u>	100																																		
6	<u>46</u>	<u>42</u>	<u>47</u>	<u>42</u>	<u>45</u>	100																																	
7	<u>63</u>	<u>48</u>	22	<u>49</u>	<u>34</u>	<u>41</u>	100																																
8	<u>47</u>	<u>30</u>	<u>50</u>	<u>44</u>	<u>31</u>	<u>49</u>	<u>30</u>	100																															
9	<u>56</u>	<u>50</u>	<u>34</u>	<u>53</u>	<u>46</u>	<u>49</u>	<u>47</u>	24	100																														
10	<u>41</u>	<u>44</u>	<u>35</u>	<u>56</u>	<u>53</u>	<u>53</u>	<u>52</u>	<u>56</u>	<u>56</u>	100																													
11	<u>40</u>	<u>24</u>	<u>25</u>	<u>45</u>	<u>39</u>	<u>33</u>	<u>38</u>	<u>36</u>	<u>51</u>	<u>64</u>	100																												
12	<u>-32</u>	<u>-31</u>	<u>-26</u>	<u>-19</u>	<u>-20</u>	<u>-25</u>	<u>-41</u>	<u>-22</u>	<u>-39</u>	<u>-48</u>	<u>-24</u>	100																											
13	22	19	20	<u>28</u>	23	<u>30</u>	<u>32</u>	<u>37</u>	<u>26</u>	<u>52</u>	<u>50</u>	-19	100																										
14	<u>35</u>	<u>44</u>	<u>32</u>	<u>42</u>	<u>34</u>	<u>55</u>	<u>32</u>	<u>45</u>	<u>42</u>	<u>51</u>	<u>37</u>	-24	<u>39</u>	100																									
15	04	07	12	02	19	08	01	-13	16	-11	-03	11	06	-18	100																								
16	-03	01	-07	05	18	04	-04	-18	24	00	-00	04	05	-23	<u>55</u>	100																							
17	24	22	23	05	07	07	16	-02	<u>26</u>	-03	-12	-07	-11	-03	<u>21</u>	23	100																						
18	-02	-06	-11	00	-07	-17	-07	<u>-26</u>	04	<u>-30</u>	<u>-26</u>	<u>39</u>	<u>-27</u>	-12	14	21	<u>48</u>	100																					
19	07	11	07	07	06	13	11	<u>30</u>	-00	<u>38</u>	<u>29</u>	<u>-40</u>	<u>27</u>	23	-19	<u>-28</u>	<u>-47</u>	<u>-88</u>	100																				
20	-09	-09	<u>-25</u>	-06	-20	<u>-30</u>	-04	<u>-29</u>	<u>-26</u>	<u>-23</u>	-05	20	-07	<u>-31</u>	17	18	-20	15	-13	100																			
21	18	12	21	07	<u>30</u>	<u>27</u>	09	<u>30</u>	<u>26</u>	22	07	-19	08	<u>30</u>	-13	-13	20	-10	14	<u>-87</u>	100																		
22	12	24	-12	09	09	-03	16	13	09	05	02	07	13	04	07	01	06	07	-04	09	-07	100																	
23	-11	-18	08	-18	-15	-01	-14	-09	-13	-07	-14	-09	-11	-04	-09	03	-00	-10	06	-07	12	<u>-89</u>	100																
24	-08	01	-09	-13	-13	-11	-22	-14	<u>-26</u>	<u>-28</u>	-11	<u>41</u>	-15	-24	06	09	-21	23	<u>-25</u>	<u>53</u>	<u>-50</u>	<u>28</u>	<u>-34</u>	100															
25	06	-01	06	13	05	04	<u>26</u>	08	22	20	03	<u>-37</u>	10	18	01	-06	<u>27</u>	-12	17	<u>-39</u>	<u>36</u>	-14	<u>21</u>	<u>-93</u>	100														
26	-05	10	07	-10	06	-04	-08	-15	04	04	-04	<u>04</u>	20	02	<u>32</u>	<u>40</u>	<u>21</u>	-07	03	08	-11	-07	06	<u>07</u>	-03	100													
27	-02	-09	24	07	09	00	06	05	13	07	15	-22	07	-11	<u>09</u>	<u>08</u>	22	-15	10	-17	13	<u>-44</u>	<u>36</u>	<u>-42</u>	<u>37</u>	03	100												
28	<u>-33</u>	<u>-31</u>	-17	-23	<u>-30</u>	-20	-16	<u>-29</u>	-19	<u>-31</u>	02	10	-10	-21	04	04	-22	-08	05	<u>30</u>	<u>-31</u>	<u>-19</u>	<u>24</u>	<u>06</u>	-08	-14	<u>33</u>	100											
29	-19	-05	-16	-20	-10	<u>-28</u>	<u>-27</u>	<u>-26</u>	-23	-10	-12	20	10	-06	01	13	-05	11	-10	<u>30</u>	<u>-26</u>	12	-05	<u>34</u>	<u>-34</u>	<u>28</u>	<u>-40</u>	-07	100										
30	-08	-14	<u>-27</u>	02	-04	<u>-12</u>	<u>-05</u>	<u>-27</u>	-15	-14	11	<u>26</u>	-03	-16	-08	-01	-06	17	-15	<u>35</u>	<u>-29</u>	<u>27</u>	<u>-29</u>	<u>34</u>	<u>-29</u>	-04	<u>-26</u>	23	21	100									
31	11	06	19	15	<u>28</u>	10	17	16	<u>25</u>	22	10	-19	07	02	11	16	<u>30</u>	-14	21	<u>-26</u>	<u>33</u>	<u>-25</u>	<u>29</u>	<u>-55</u>	<u>53</u>	18	<u>73</u>	05	<u>-42</u>	-20	100								
32	-22	<u>-27</u>	-16	-14	-20	-08	<u>-28</u>	-19	-13	<u>-30</u>	-05	15	-13	-23	12	06	<u>-35</u>	-10	01	23	<u>-27</u>	<u>-28</u>	<u>25</u>	<u>12</u>	-18	-15	17	<u>69</u>	-06	14	-16	100							
33	00	-02	11	13	-08	-08	04	11	11	-11	08	-06	02	-09	15	17	<u>10</u>	15	-12	02	10	<u>-28</u>	<u>25</u>	-06	04	-16	<u>49</u>	<u>26</u>	<u>-39</u>	-14	<u>36</u>	21	100						
34	08	18	-14	12	09	08	10	11	-03	09	-04	24	10	11	-01	08	-08	20	-24	08	-07	<u>45</u>	<u>-40</u>	<u>36</u>	<u>-32</u>	15	<u>-72</u>	<u>-50</u>	<u>29</u>	19	<u>-55</u>	<u>-29</u>	<u>-38</u>	100					

Decimal point omitted.

Underlined values are significant at the 5% level.

to exist between the Thinking and Work Habits and some personality variables. Correlations between the Meyers-Briggs (MB) "Feeling" and the "Low vs. High Work Potential" Scale range between 0,40 (for the Afrikaans speaking sample) and 0,42 (for the English speaking sample). Similarly the correlation between "Thorough vs. Careless Work Performance" and "MB - Judging" is between -0,55 to -0,63. The scores from the Temperament Questionnaire are highly correlated with "Versatile vs. Rigid Work Performance", (-0,44).

The intercorrelations between Thinking and Work Habits require further elaboration. It will be remembered that three of the four Thinking and Work Habits are very similar with regard to their operational definitions. Intercorrelations between them are rather high and range from 0,39 to 0,73 for both samples. This appears to indicate that the similarity of definitions causes the high degree of mutual relationships between the Work Habits and Thinking Habits from which the former were inferred (See : pilot study). These results can therefore be considered as a first confirmation that Thinking Habits can influence and/or determine Work Habits in a professional work situation. If it is taken into consideration that the subjects participating in this investigation were drawn from different professional fields, institutes and levels of functioning, the interpretation of the findings could be extended to the point where it is assumed that the Work and Thinking Habits are relatively independent of the job content, the nature of work and level of functioning. A strong influence of these job demands on work habits would have acted as a moderator variable - with the result that the inter-correlations between Thinking and Work Habits should not have been as high as 0,73. It is therefore not unreasonable to assume that these high intercorrelations represent a more

comprehensive concept of relatively stable Problem-Solving Styles.

The assumption that the Thinking and Work Habits are unidimensional (as stated in the pilot investigation) has been proven incorrect.

Significant correlations (on the 5% level) were obtained in the matrix for the Afrikaans speaking sample, between "Rigorous versus Digressive Thinking" and "Versatility versus Rigidity in Thinking" as well as "Ideational Conformity versus Ideational Independence". Similarly high significant correlations were obtained for both sample groups (English and Afrikaans speaking), between Work Habits and "Thorough versus Careless Work Performance" as well as with "Low versus High Performance Potential". The existence of other interrelationship patterns between the various scales formed part of the factor analyses.

The correlations between the separately scored dichotomous dimensions of the Myers-Briggs Type Indicator (MBTI) resulted in high negative values, viz. between $-0,86$ and $-0,96$ for both language samples. The inter-correlations of both polarities of each dimension with all other test variables are very similar regarding their values, but are distinguished by their signs. For example, in the case of dimension "Judging - Perception" the first polarity is correlated with the Scale "Thorough versus Careless Work Performance" to the extent of $-0,63$, whereas the correlation of the "Perception" with the same scale is $0,64$ (for the English speaking sample). It appears that it is unnecessary to retain the two polarities of each dimension. Therefore, it was decided to incorporate only one polarity

of each dimension for further analysis. The following variables of the Myers-Briggs Type Indicator were excluded from further analysis: Extroversion, Intuition, Thinking, Perception.

A comparison of the correlation matrices for the Afrikaans and English speaking samples reveals that a separation of both samples for analysis purposes is justified. Inter-correlations between some variables show striking differences. For the Afrikaans speaking sample, the correlation between "Locations" and "Inference" is 0,19, and for the English speaking sample, it is 0,46. The correlation between "Pattern Completion" and "Inference" for the Afrikaans speaking sample is 0,53 and for the English speaking sample, it is 0,21. Also, the correlations between "Judging - Sensing", "Ideational Conformity and Rigorous Thinking" reveal differences between both samples.

6.4 INTER-BATTERY FACTOR ANALYSIS : THINKING AND WORK HABITS - PERSONALITY VARIABLES.

The first Inter-Battery Factor Analysis, according to Tucker's method (1958), was applied to establish the relationship between personality variables on the one hand and Thinking and Work Habits on the other hand. The same two batteries were applied to both the Afrikaans and English speaking groups, containing the following variables:

TABLE 14.

Variables No.	Description.
<hr/>	
<u>BATTERY 1.</u>	
1.	Age.
2.	Temperament (Temp.)
3.	MB - Introversion (Intro.)
4.	MB - Sensing (Sens.)
5.	MB - Feeling (Feel.)
6.	MB - Judging (Judge.)
<hr/>	
<u>BATTERY 2.</u>	
1.	Rigorous vs. Digressive Thinking (T.H. No 1)
2.	Versatility vs. Rigidity in Thinking (T.H. No 2)
3.	Ideational Conformity vs. Ideational Independence (T.H. No 3)
4.	Daydreaming vs. Lack of Daydreaming (T.H. No 4)
5.	Thorough vs. Careless Work Performance (W.H. No 1)
6.	Versatile vs. Rigid Work Performance (W.H. No 2)
7.	Independent vs. Dependent Work Performance (W.H. No 3)
8.	Low Performance Potential vs. High Performance Potential (W.H. No 4)
<hr/>	

The common factors for both batteries were extracted from a matrix of correlations between the variables of battery 1 and battery 2. The matrices A_1 (for battery 1) and A_2 represent the common factors for both batteries in such a manner that Factor 1 of Matrix A_1 is common with Factor 1 of Matrix A_2 , etc. Factors of both batteries will be jointly interpreted.

The oblique rotation of factors was not done independently for both matrices as proposed by Tucker (1958, p. 130). Due to the bi-polarity of the variables which determine the factors, the sign of their loadings were changed separately with separate loadings. This meant that a joint interpretation of the common factors of both matrices was practically impossible.

6.4.1 AFRIKAANS SPEAKING SAMPLE.

See Tables

TABLE 15
INTER-BATTERY CORRELATION MATRIX
 (Afrikaans Speaking)

Battery 1 \ Battery 2	1. Age	2. Temp.	3. Intro.	4. Sense.	5. Feel.	6. Judge.
	1. T.H. No. 1	-0,221	0,216	0,100	-0,172	0,361
2. T.H. No. 2	0,097	-0,215	0,047	0,299	0,239	0,064
3. T.H. No. 3	0,201	-0,053	-0,096	0,299	-0,054	0,341
4. T.H. No. 4	0,259	-0,060	-0,146	0,346	-0,289	0,337
5. W.H. No. 1	-0,189	0,301	0,210	-0,259	0,291	-0,550
6. W.H. No. 2	0,146	-0,350	0,006	0,228	0,250	0,116
7. W.H. No. 3	-0,062	0,102	-0,118	0,023	0,253	-0,061
8. W.H. No. 4	0,242	-0,083	-0,237	0,083	-0,397	0,356

TABLE 16
FACTOR MATRICES

Factors \ Variables	Unrotated Matrix A1		Rotated Matrix A1	
	1	2	1	2
	1. Age	0,4316	0,0779	0,3694
2. Temp.	-0,3541	-0,3558	-0,1877	-0,4426
3. Intro.	-0,2767	0,0999	-0,2960	0,0205
4. Sense.	0,4673	0,3990	0,2756	0,5157
5. Feel.	-0,4938	0,6345	-0,7086	0,4789
6. Judge.	0,7662	-0,0068	0,7131	0,2048
Factors \ Variables	Unrotated Matrix A2		Rotated Matrix A2	
	1	2	1	2
	1. T.H. No. 1	-0,5412	-0,1118	-0,5460
2. T.H. No. 2	0,1226	0,5111	-0,0883	0,5293
3. T.H. No. 3	0,3899	0,1530	0,3011	0,2559
4. T.H. No. 4	0,5123	-0,0289	0,4864	0,1133
5. W.H. No. 1	-0,6498	-0,0224	-0,5937	-0,2010
6. W.H. No. 2	0,1794	0,5481	-0,0503	0,5808
7. W.H. No. 3	-0,1336	0,1663	-0,1896	0,1244
8. W.H. No. 4	0,4929	-0,2793	0,5674	-0,1348

Intercorrelation of Factors : $r_{12} = 0,125$

The two Factors which were extracted were not highly correlated. The variables which were used for the interpretation are underlined. Generally, variables with loadings well above 0,30 were included in the interpretation.

In the case of the Myers-Briggs variables, negative loadings were interpreted as the polar opposite incorporated in a particular dimension. This procedure was justified in view of the intercorrelations of polarities of these dimensions. (See : 6.3). Similarly the polar opposites of the Thinking and Work Habit scales were interpreted according to the (positive or negative) sign of their factor loadings.

Factor 1 of Matrix A_1 shows high positive loadings on the "Judging" and "Age" variables of Myers-Briggs. The high negative loading on Myers-Briggs "Feeling" is interpreted in terms of its polar opposite, viz. "Thinking".

The Myers-Briggs variable "Judging" refers to a critical attitude towards the environment and a particular preference for arranging one's life according to a fixed schedule. "Thinking" describes a relatively unemotional and impersonal approach towards problems where decisions are taken on the basis of objective logical processes.

It is not surprising that the variable "Age" is combined in this factor with these variables. It can be assumed that increasing age generates a more organized and stringent attitude to cope with the environment as contrasted to a highly flexible behaviour.

Factor 1 of Matrix A_2 had high loadings on

"Rigorous Thinking" (T.H. No 1), "Lack of Daydreaming" (T.H. No 4), "Thorough Work Performance" (W.H. No 1) and "High Performance Potential" (W.H. No 4).

The description of these variables indicates that they are closely interrelated. "Rigorous Thinking" was defined as thought processes which follow a strict sequence and are aimed towards a clearly defined goal. Concentration is a pre-requisite to prevent thoughts deviating from the subject under consideration. The interrelation of this variable with "Lack of Daydreaming" is obvious, as is the case with "Thorough Work Performance" which involves accuracy and precision, neat and orderly procedure.

An interesting interrelation exists between the abovementioned variables and "High Performance Potential". Subjects who display the above characteristics rate themselves also high on this scale, the items of which are mostly referring to the easy formulation of ideas, and/or the solving of difficulties in their work. They do not often interrupt their work to relax and are (more generally) convinced as to the value and validity of their research efforts.

The strong interrelation between the Thinking and Work Habits is confirmed by the findings of this factor. However, as stated before, the assumption that the Thinking Habits are independent dimensions has become untenable. The same applies to the Work Habits.

From the above discussion it appears that the first "pair of factors" from Matrix 1 and 2 can be jointly interpreted.

The underlying rationale of the personality variables is that of an impersonal and unemotional evaluation of the environment, facilitating objective and logical judgements. Furthermore, consistency plays a major role in that acting according to schedules and regulations is preferred rather than the adaptation to changing situations.

Thinking and Work Habits fit well into this pattern. Generally speaking, the emphasis is on logical proceeding with good concentration. This effects the work in such a way that accuracy, neat and orderly working is preferred, and that thoughts seldom deviate from the work at hand. The result is that ideas can be clearly formulated.

The above interpretation of the results can be summarized under the concept of "stability". It explains the most prominent characteristics of these Thinking and Work Habits as well as the personality characteristics. Bearing in mind that this concept (factor) is dichotomous, it is suggested to call it "Stability versus Instability". With the identification of this factor it was possible to extend the concept of Thinking Habits in such a manner that it also contains its interaction with the measured Work Habits and personality traits. According to the previous definition, this factor can be considered as a "problem-solving style" which, as yet, does not explain its relation to cognitive functioning.

Factor 2 of Matrix A_1 is determined by the variables "Temperament" and Myers-Briggs "Sensing" and "Feeling". "Temperament" shows a negative loading. Since this variable measures the "degree of primary functioning" it will be interpreted in terms of its polar opposite, viz. "secondary functioning". This reflects a low level of stimulus

arousal, resulting in an even mood and steadiness, as well as tenacity. This variable is closely interrelated with Myers-Briggs "Sensing", since the latter refers to people who prefer work of a routine nature, where they display patience and reluctance to adapt to changing circumstances. The relationship of these two variables with Myers-Briggs "Feeling" is not so obvious. Its items refer mostly to an empathetic attitude towards other people, where an element of submissiveness is observed and where decisions are often influenced by others. It was therefore necessary to consider the factor loadings of Matrix A_2 first before a sensible interpretation of these results could be made.

With regard to Matrix A_2 scales - T.H. No 2 (Rigidity in Thinking) and W.H. No 2 (Rigid Work Performance) emerged with high loadings. Once again, there exists a close interrelation between Work Habits and Thinking Habits. Both involve a slow and tedious generating of ideas on the one hand and a slow tempo of work and concentration on a few tasks on the other hand.

The joint interpretation of Factor 2 reveals that the concept of "Rigidity" prevailing in Matrix A_2 is also involved to some extent in the variable "Sensing" and "Temperament". If it is taken into account that "primary functioning" is highly correlated with "Extraversion" (Retief, 1969), an interesting interpretation of these results is possible. Eysenck (1967) interpreted the interrelationship between "Extraversion", "Fluency and/or flexibility" measures in such a manner whereby the extrovert displays greater flexibility to recall conscious contents. It should also be kept in mind that positive interrelations between "Extraversion" and "Fluency" measures were found with other investigations. (Pemberton, 1952; Denton and Taylor, 1955; Rogers, 1956).

This interpretation is confirmed again with the results on this factor where "Secondary Functioning" (or "Introversion") is clearly combined with "Rigidity" in respect of Thinking and Work Habits. It can therefore be assumed that "Introversion" is determined to some extent by a lack of flexibility. Considering the behavioural pattern of, e.g. the "Extravert" (which implies a quick and lively reaction on the social level, immediate communication with a variety of people, etc.) it is reasonable to assume that versatility in thinking is necessary to display this kind of behaviour.

This approach in interpreting the results can also be used to explain why the variable "Feeling" loads on this factor. It appears that this variable contains a basic element of "Introversion", in that a submissive attitude is displayed by those people who want to please others and who are readily influenced in their decisions by their environment. The element of "Rigidity" can be explained by the fact that a passive, receptive attitude is displayed towards the environment, rather than an active attitude, which is characterized by versatility and flexibility of action and behaviour. Some facets of the variable "Feeling" appear to be inversely related to Cattell's (1957) "Social Initiative" which has been proven to be correlated with measures of "Extraversion" (Brandtstädter, 1972).

The above discussion reveals that the concept of "Rigidity" described Factor 2 of Matrix A₂ very well. It would therefore be appropriate to call this problem-solving style "Rigidity versus Flexibility".

6.4.2 ENGLISH SPEAKING SAMPLE.

See Tables.

TABLE 17
INTER-BATTERY CORRELATION MATRIX
(English Speaking)

Battery 1 Battery 2	1. Age	2. Temp.	3. Intro.	4. Sense.	5. Feel.	6. Judge.
1. T.H. No. 1	-0,026	0,095	-0,043	-0,070	0,339	-0,262
2. T.H. No. 2	-0,024	-0,234	-0,103	0,215	0,206	-0,019
3. T.H. No. 3	0,007	-0,206	-0,115	0,056	-0,265	0,101
4. T.H. No. 4	-0,026	-0,208	0,099	0,290	-0,272	0,101
5. W.H. No. 1	-0,037	0,174	-0,024	-0,210	0,227	-0,632
6. W.H. No. 2	-0,033	-0,442	0,184	0,156	0,010	0,114
7. W.H. No. 3	-0,078	0,099	-0,071	0,108	0,244	0,026
8. W.H. No. 4	0,032	-0,100	0,034	-0,052	-0,417	0,263

TABLE 18
FACTOR MATRICES

Factors Variables	Unrotated Matrix A1		Rotated Matrix A1	
	1	2	1	2
1. Age	-0,0372	0,0914	-0,0788	-0,0641
2. Temp.	<u>0,4455</u>	<u>0,4571</u>	0,1499	-0,6120
3. Intro.	-0,1100	-0,2114	0,0134	0,2387
4. Sense.	-0,2801	-0,3904	-0,0416	<u>0,4763</u>
5. Feel.	<u>0,6097</u>	<u>-0,4597</u>	<u>0,7602</u>	0,1272
6. Judge.	<u>-0,6574</u>	0,0800	<u>-0,6071</u>	0,2323
	Unrotated Matrix A2		Rotated Matrix A2	
1. T.H. No. 1	<u>0,4089</u>	-0,1568	<u>0,4323</u>	-0,0494
2. T.H. No. 2	-0,0332	<u>-0,4935</u>	0,2238	<u>0,4540</u>
3. T.H. No. 3	-0,2963	0,0618	-0,2868	0,0818
4. T.H. No. 4	<u>-0,3813</u>	-0,1560	-0,2486	0,3147
5. W.H. No. 1	<u>0,6353</u>	0,0132	<u>0,5401</u>	-0,3050
6. W.H. No. 2	<u>-0,3006</u>	<u>-0,4763</u>	-0,0153	<u>0,5621</u>
7. W.H. No. 3	0,1427	-0,1569	0,2031	0,0736
8. W.H. No. 4	<u>-0,4226</u>	0,2901	<u>-0,5123</u>	-0,0628

Intercorrelation of Factors : $r_{12} = -0,057$

The English speaking sample produced a very similar pattern as compared with the Afrikaans speaking sample. Factor 1 of the Matrix A_1 and A_2 however, shows an inverse relationship in that the "Feeling" and "Perceiving" polarity appears in A_1 and "Digressive Thinking", "Careless Work Performance" and "Low Performance Potential" in Matrix A_2 . Since this factor can be reflected, the same approach for the interpretation of the results was used as for the Afrikaans speaking sample. Variables of the one polarity refer to instability aspects of Thinking and Work Habits, whereas the other polarity represents a stability dimension. Therefore this factor is also called "Stability versus Instability".

Factor 2 of both matrices emerges in the same manner as the previously identified Factor 2 for the Afrikaans speaking sample. "Secondary functioning" and Myers-Briggs "Feeling" have high loadings in A_1 , "Rigidity in Thinking" and "Rigid Work Performance" similarly show high loadings in A_2 . Therefore, it was no problem to interpret this factor as a "Rigidity versus Flexibility" problem solving style.

6.4.3 COMPARISON OF AFRIKAANS AND ENGLISH SPEAKING SAMPLES.

As already indicated, both samples resemble each other very closely with regard to problem-solving styles. Differences were observed only when the number of variables with high loadings on each factor were considered. Generally speaking, there are more variables with high loadings in the Afrikaans speaking sample than in the English speaking sample. The variable "Age" was not included in the first factor, and T.H. No 4 was also not significantly loaded. In Factor 2, "Feeling" was not retained as was the case with the Afrikaans

speaking sample. One conclusion which can be drawn from these rather small differences is that Afrikaans speaking subjects show somewhat more stability in their characteristics of problem-solving styles than the English speaking subjects.

Apart from these differences it must be emphasized that the basic characteristics of the problem-solving styles, with regard to both samples, remain constant. There is only a slight variation as regards those aspects which determine these characteristics.

6.4.4 COMPARISON OF UNROTATED AND ROTATED FACTOR MATRICES.

Both rotated and unrotated matrices are very similar for the Afrikaans and English speaking samples. This is not surprising since the factors used for both samples show very low correlations, which means that in spite of the oblique rotations factors remained relatively uncorrelated. The interpretation of the unrotated matrices therefore does not necessitate a change with regard to the approach used for the interpretation of the results. For the Afrikaans speaking sample, the unrotated Matrix A_1 shows two variables with substantial loadings, viz. "Temperament" and "Sensing". Their interrelation with the "Rigidity - Flexibility" style was already mentioned and it appears logical that some facets of these variables can also be related to a "Stability - Instability" style. In Matrix A_2 only T.H. No 3 emerged with an additional high loading. This also fits well into the interpretation of the factor. "Ideational Independence" involves the need for changing ideas, being seldom distracted by the ideas of others, reluctance to accept proposals from others, etc. This obviously does not mean that there is no need for these thinking

process characteristics to show an element of "stability".

Apart from small variations in the size of the factor loadings, Factor 2 of the unrotated and rotated matrix are virtually identical.

Comparing the rotated and unrotated matrices of the English speaking sample a similar pattern emerges as in the case of the Afrikaans speaking sample. "Primary Functioning" and T.H. No 4, (Daydreaming) appear with substantial loadings as "new" variables in the unrotated matrix. It is again reasonable to assume that these variables describe certain aspects of instability. In every other aspect the unrotated Factor 2 is virtually identical with the rotated Factor 2.

The differences obtained with regard to both matrices can be perceived as an indicator of the "relative" stability of some variables determining "problem-solving styles".

6.5

INTER - BATTERY ANALYSIS : PERSONALITY VARIABLES,
THINKING AND WORK HABIT VARIABLES AND COGNITIVE VARIABLES.

The next step for the identification of problem-solving styles as they were inferred on an a priori basis, was to investigate their interrelation with cognitive abilities.

The earlier styles identified did not involve all the variables of the inter-battery analysis and therefore were not excluded. This was done to avoid the possible loss of valuable information and in view of the fact that the stability of the factor analyses would not be decreased significantly by the exclusion of e.g. merely two or three variables.

The Inter-Battery Analyses were done separately again, for the English and Afrikaans speaking samples.

Battery 1 included all Thinking and Work Habit scales and personality variables. Battery 2 consisted of all cognitive tests. In tables number twenty and twenty-one they appear with the following numbers and abbreviations:

TABLE 19.

BATTERY 2.

1.	Loc.	Locations
2.	D.R.T.	Deductive Reasoning Test
3.	Card Rot.	Card Rotation
4.	Let. Set.	Letter Set
5.	Inf.	Inferences
6.	Cube Comp.	Cube Comparison
7.	Fig. Class.	Figure Classification
8.	Blox	Blox Test
9.	Reas. Ab.	Reasoning Abilities
10.	Pat. Compl.	Pattern Completion
11.	Fig. Ser.	Figure Series
12.	Com. Elem.	Common Elements
13.	Gottsch. Fig.	Gottschaldt Figures
14.	See. Faults	Seeing Faults
15.	Consequ.	Consequences
16.	Qual.	Qualities Tests

The interpretation so far had to take into account the bi-polar measuring approach used in this investigation with regard to the personality variables and the Thinking and Work Habits. In this respect, however, the cognitive abilities present a problem, since they do not contain polar opposites and cannot be interpreted in the same way.

With regard to the dichotomous variables the positive or negative loadings of cognitive tests therefore had to be interpreted as high or low achievement. This meant that it was not possible to identify or "label" each factor finding. This was not necessarily a disadvantage since there was merely a need to study the interrelation between the problem-solving styles and cognitive functioning.

6.5.1 AFRIKAANS SPEAKING SAMPLE.

See tables.

TABLE 20

FACTOR MATRICES (AS)

Factors Variables	UNROTATED MATRIX A1				ROTATED MATRIX A1			
	1	2	3	4	1	2	3	4
	1. Age	<u>0,7317</u>	-0,0086	0,0645	-0,1588	-0,3323	-0,5023	0,0899
2. Temp.	-0,1883	<u>0,6156</u>	0,1011	-0,1094	0,2304	-0,0532	<u>0,5464</u>	0,3088
3. Int.	<u>0,4162</u>	- <u>0,4870</u>	0,0794	0,1081	0,0785	0,2716	- <u>0,5476</u>	0,0956
4. Sense.	<u>0,4618</u>	0,1991	0,1426	<u>0,3862</u>	- <u>0,6073</u>	0,0703	0,2713	0,0585
5. Feel.	<u>0,2268</u>	-0,0335	0,0189	-0,3217	0,1090	- <u>0,3930</u>	-0,0195	-0,0930
6. Judge.	<u>0,3878</u>	0,1369	0,1258	-0,0793	-0,1970	-0,2954	0,1714	0,0151
7. T.H. No 1.	-0,1146	0,1669	-0,2210	0,1248	0,0672	0,2337	0,1868	-0,1128
8. T.H. No 2.	<u>0,5593</u>	-0,1078	-0,2427	0,0936	-0,3304	-0,0960	0,0298	- <u>0,4342</u>
9. T.H. No 3.	<u>0,3826</u>	0,0076	<u>0,4643</u>	0,0498	- <u>0,4315</u>	-0,2912	-0,0003	0,3070
10. T.H. No 4.	<u>0,2803</u>	-0,1280	-0,0043	<u>0,3563</u>	- <u>0,4601</u>	0,1845	-0,0557	-0,1039
11. W.H. No 1.	- <u>0,3565</u>	0,2935	0,0181	0,1343	0,1315	0,2724	0,2340	0,2240
12. W.H. No 2.	<u>0,4799</u>	0,0110	-0,2587	-0,0473	-0,1532	-0,1790	0,1261	- <u>0,4024</u>
13. W.H. No 3.	-0,0081	0,2213	- <u>0,3277</u>	0,1546	0,0249	0,2448	0,2757	-0,2311
14. W.H. No 4.	-0,1616	0,0269	<u>0,3231</u>	0,1189	-0,1108	0,0706	-0,0431	0,3702
	UNROTATED MATRIX A2				ROTATED MATRIX A2			
	1	2	3	4	1	2	3	4
1. Loc.	- <u>0,4029</u>	0,1905	0,0940	0,0034	0,2237	0,1561	0,1058	0,2728
2. D.R.T.	- <u>0,3802</u>	0,1412	0,3095	0,0048	0,1264	0,0753	0,0276	0,4521
3. Card Rot.	- <u>0,3722</u>	0,2439	-0,2333	-0,2902	<u>0,5604</u>	-0,0062	0,1953	-0,0499
4. Let. Set.	- <u>0,3717</u>	0,0919	-0,0775	0,2357	0,0367	<u>0,3761</u>	0,0663	0,0758
5. Inf.	- <u>0,3828</u>	0,0895	0,1031	0,0446	0,1647	0,1816	0,0118	0,2514
6. Cube Comp.	- <u>0,3684</u>	-0,0519	-0,0996	-0,2283	<u>0,4284</u>	0,0069	-0,1093	0,0005
7. Fig. Class.	- <u>0,4485</u>	0,1160	-0,0617	0,2378	0,1131	<u>0,4361</u>	0,0653	0,1430
8. Blox.	- <u>0,4782</u>	-0,0988	-0,0924	-0,1372	<u>0,4137</u>	0,1364	-0,1681	0,0392
9. Reason. Ab.	- <u>0,4690</u>	0,2705	-0,2533	-0,0358	<u>0,4271</u>	0,2678	0,2250	-0,0089
10. Pat. Compl.	- <u>0,5844</u>	-0,2081	0,1334	0,0760	0,2153	0,2988	-0,3136	0,2725
11. Fig. Ser.	- <u>0,2121</u>	-0,2011	-0,2202	<u>0,3699</u>	-0,1098	<u>0,5003</u>	-0,1720	-0,1557
12. Com. El.	-0,2340	-0,2044	0,1215	0,2172	-0,0991	0,2624	-0,2422	0,1553
13. Gott. Fig.	- <u>0,3900</u>	-0,2432	0,1471	-0,1964	0,3063	-0,0343	-0,3360	0,1891
14. See. F.	0,1006	<u>0,4071</u>	-0,0991	0,0833	-0,0444	0,0514	<u>0,4339</u>	-0,0132
15. Conseq.	0,1181	<u>0,4888</u>	0,0488	0,1170	-0,1253	0,0215	<u>0,4953</u>	0,1418
16. Qual.	-0,0415	<u>0,2166</u>	<u>0,5315</u>	-0,0175	-0,1278	-0,1784	0,1197	<u>0,5614</u>

TABLE 21

INTER - BATTERY CORRELATION MATRIX.

Battery 2 Battery 1	1. Loc.	2. D.R.T.	3. Card. Rot.	4. Let. Set.	5. Inf.	6. Cube.Comp.	7. Fig. Class	8. Blox.	9. Reas. Ab.	10. Pat.Compl.	11. Fig. Ser.
1. Age	-0,320	-0,311	-0,261	-0,194	-0,204	-0,250	-0,411	-0,224	-0,394	-0,475	-0,235
2. Temp.	0,239	0,220	0,229	0,053	0,065	0,069	0,157	-0,022	0,260	-0,033	-0,115
3. Int.	0,067	0,112	0,069	0,074	0,062	0,128	0,114	0,299	-0,000	0,375	0,285
4. Sense.	-0,092	-0,091	-0,254	-0,062	-0,198	-0,299	-0,040	-0,288	-0,263	-0,226	-0,047
5. Feel.	-0,112	-0,176	0,081	-0,181	-0,149	-0,008	-0,144	-0,090	-0,130	-0,070	-0,142
6. Judge.	-0,081	0,006	-0,090	-0,135	-0,128	-0,113	-0,217	-0,139	-0,255	-0,281	-0,108
7. T.H. No 1.	-0,017	-0,094	0,241	0,073	0,090	0,004	0,056	0,045	0,128	0,069	0,145
8. T.H. No 2.	-0,327	-0,314	-0,173	-0,225	-0,304	-0,197	-0,159	-0,292	-0,193	-0,306	0,019
9. T.H. No 3.	-0,192	-0,050	-0,155	-0,202	-0,099	-0,283	-0,271	-0,258	-0,226	-0,103	-0,121
10. T.H. No 4.	-0,084	-0,142	-0,273	0,017	-0,039	-0,118	-0,047	-0,272	-0,146	-0,140	0,106
11. W.H. No 1.	0,109	0,055	0,191	0,150	0,282	0,100	0,171	0,159	0,245	0,216	0,100
12. W.H. No 2.	-0,220	-0,265	-0,156	-0,139	-0,197	-0,078	-0,281	-0,185	-0,125	-0,304	-0,054
13. W.H. No 3.	0,002	-0,019	0,109	0,126	-0,076	-0,084	0,035	0,113	0,111	-0,111	0,081
14. W.H. No 4.	0,081	0,180	-0,140	0,116	0,086	0,077	0,099	0,113	-0,031	0,094	-0,042

Inter-Battery Correlation Matrix (Continued)/...

INTER - BATTERY CORRELATION MATRIX (Continued)

Battery 2 Battery 1	12. Com El.	13. Gott. Fig.	14. See. F.	15. Consequ.	16. Qual.
1. Age.	-0,192	-0,238	0,110	0,038	0,042
2. Temp.	-0,110	-0,030	0,209	0,228	0,214
3. Int.	0,271	0,231	-0,193	-0,281	0,027
4. Sense.	-0,074	-0,309	0,165	0,181	0,081
5. Feel.	-0,108	-0,043	-0,085	0,031	0,064
6. Judge.	-0,149	-0,242	0,060	0,090	0,069
7. T.H. No 1.	0,070	-0,114	0,093	0,075	0,028
8. T.H. No 2.	-0,099	-0,208	0,038	0,038	-0,139
9. T.H. No 3.	0,095	-0,056	0,005	0,132	0,282
10. T.H. No 4.	-0,031	-0,163	-0,079	-0,013	-0,044
11. W.H. No 1.	0,071	0,022	0,105	0,162	0,175
12. W.H. No 2.	-0,131	-0,228	0,115	0,064	-0,154
13. W.H. No 3.	0,016	-0,087	0,150	0,170	-0,158
14. W.H. No 4.	0,095	0,105	-0,010	0,078	0,149

FACTOR CORRELATION MATRIX

	1	2	3	4
1.	1,0000	0,2848	-0,0330	0,1839
2.	0,2848	1,0000	-0,0275	0,1320
3.	-0,0330	-0,0275	1,0000	-0,0635
4.	0,1839	0,1320	-0,0635	1,0000

Before interpreting the results it is necessary to compare the rotated and unrotated matrix. It can be seen that high loadings occur more frequently in the unrotated matrix, defining the factors more effectively than in the rotated matrix. It should be kept in mind however, that with 29 variables and a relatively small sample, the factors possess a certain degree of instability. This instability is apparently increased by the joint oblique rotation of both matrices. This phenomenon has been mentioned by Tucker (1958, p. 130). In the previous inter-battery analysis, this instability did not play an important rôle, because only a few variables were processed. In the cases where there was a decrease in the stability, this could only mean that some variables with substantial loadings in the unrotated matrices did not appear again in the rotated matrices.

Since the rotated factors of the new inter-battery analysis are once again orthogonal (i.e. virtually with no correlations between the factors) there was no reason why in this case the unrotated matrix should not be interpreted.

Factor 1 of matrices A_1 and A_2 displays an interesting pattern of loadings. In Matrix A_1 high loadings are found on all but two variables determining the formerly identified problem-solving style "Stability versus Instability". Instead of the variable "Secondary Functioning" the variable "Introversion" merged with this factor. Bearing in mind the instability of the

factors this can be explained by the similarity of their operational definitions.

From the former Factor 2, two variables, viz. Rigidity in Thinking and Rigid Work Performance merged with the observed new factor. This added a part of the "Rigidity - Fluency" dimension to the concept stability of the factor.

Factor 1 of Matrix A_1 displays high negative loadings on virtually all "Reasoning" and "Spatial" tests (which are factorially highly correlated). A high negative loading on the Gottschaldt Figures Test can be explained because of its resemblance to the spatial tests. Rather unexpectedly the "Figure Series" was an exception.

There is evidence that some of the problem-solving styles and rigidity have a detrimental effect on cognitive test achievement. This influence can be explained by the fact that fast thinking and acting is a prerequisite for high test achievements. It appears that the speed factor (which is a characteristic of all cognitive tests) is to the disadvantage of subjects who display a rigid work performance, who are slow to generate ideas, or who show more generally a "tenacity" in their thinking and behaviour. The negative influence of e.g. "Age" on cognitive test achievement has been proved by various investigators. (Raven, 1948; Jones, 1959; Bäumlner, 1969; etc.) and was therefore not unexpected.

In Factor 2, the variable "Temperament" with the polarity of "Secondary Functioning" and "Extraversion" of Matrix A_1 are grouped together with "fluency" measures (Seeing Faults; Consequences). These results are of interest in that a close relationship was already observed in the

previous Factor 2 (Rigidity versus Flexibility) between "Extraversion", "Versatility in Thinking" and "Versatile Work Performance". The influence of "Extraversion" determinants of "Flexibility" explains this relationship.

Practically the same factor as Factor 2 was identified by Brandstädter (1972) where "Extraversion" was factor analytically clustered with fluency or flexibility variables. These findings tend to confirm that the interrelationships identified with Factor 2 are not coincidental.

The joint interpretation of Factor 3 of both Matrices was difficult. The few high loadings ("Ideational Independence", and "Qualities Test") with two relatively low loadings, (Independent Work Performance and High Performance Potential) fall into a rather inconsistent pattern. It was rather unexpected that the "Qualities Test" does not fall into Factor 2 with the other "fluency" tests, particularly when considering the relatively high inter-correlation between all three tests. It could be assumed that this result might be due to an instability of the factors used. Such an assumption, poor as it may be, is however, preferred to the unjustified "over-interpretation" of the results.

It is for the same reasons that Factor 4 (with only one substantial loading in Matrix A₁) was not interpreted.

6.5.2 ENGLISH SPEAKING SAMPLE.

See Tables.

TABLE 22

INTER - BATTERY CORRELATION MATRIX (ES)

Battery 2 Battery 1	1. Loc.	2. D.R.T.	3. Card. Rot.	4. Let. Set.	5. Inf.	6. Cube.Comp.	7. Fig. Class.	8. Blox.	9. Reas. Ab.	10. Pat. Compl.	11. Fig. Ser.
1. Age.	-0,277	-0,144	-0,006	-0,132	-0,168	-0,021	-0,049	-0,105	-0,219	-0,408	-0,198
2. Temp.	-0,316	-0,100	-0,152	-0,172	0,153	-0,028	0,022	-0,121	-0,063	-0,212	0,015
3. Int.	0,291	0,202	0,088	0,323	-0,028	0,012	0,081	0,183	0,174	0,236	0,017
4. Sense.	-0,178	-0,061	-0,056	0,062	-0,100	-0,047	0,001	0,165	0,021	-0,022	0,003
5. Feel.	-0,064	0,030	0,048	0,062	0,041	-0,198	0,081	-0,167	-0,115	-0,115	-0,019
6. Judge.	-0,050	-0,129	-0,209	-0,146	-0,210	-0,173	-0,245	-0,078	-0,241	-0,103	-0,223
7. T.H. No 1.	-0,155	-0,148	-0,119	-0,068	0,050	-0,134	-0,034	-0,093	-0,059	-0,232	-0,137
8. T.H. No 2.	0,045	-0,129	-0,293	-0,142	-0,148	-0,252	-0,113	-0,113	-0,110	-0,079	0,054
9. T.H. No 3.	0,080	-0,158	-0,023	-0,114	-0,157	0,207	0,007	0,073	-0,106	0,065	0,056
10. T.H. No 4.	-0,046	-0,093	0,041	0,154	-0,025	-0,052	0,013	-0,000	0,021	0,066	0,008
11. W.H. No 1.	-0,053	0,100	0,231	0,186	0,298	0,147	0,158	0,094	0,232	0,042	0,067
12. W.H. No 2.	0,127	-0,039	-0,176	-0,101	-0,033	-0,207	-0,086	-0,082	-0,193	-0,082	-0,093
13. W.H. No 3.	-0,210	0,154	-0,135	-0,078	0,053	-0,104	0,061	-0,052	-0,135	-0,112	-0,022
14. W.H. No 4.	0,011	0,021	0,187	0,090	-0,091	0,084	0,025	0,005	-0,088	0,116	0,052

Inter-Battery Correlation Matrix (Continued)/.....

INTER - BATTERY CORRELATION MATRIX (Continued)

Battery 2	12. Com. El.	13. Gott. Fig.	14. See. F.	15. Consequ.	16. Qual.
Battery 1					
1. Age.	0,046	-0,209	0,064	0,037	0,144
2. Temp.	-0,198	-0,113	0,155	0,112	0,236
3. Int.	0,224	0,201	-0,106	-0,116	-0,112
4. Sense.	-0,082	-0,203	-0,203	-0,145	-0,027
5. Feel.	-0,077	-0,143	0,072	0,050	-0,059
6. Judge.	0,046	-0,103	-0,111	0,024	0,018
7. T.H. No 1.	-0,003	-0,069	0,198	0,099	0,069
8. T.H. No 2.	-0,080	-0,134	-0,167	-0,177	-0,095
9. T.H. No 3.	-0,061	-0,101	-0,121	0,139	0,104
10. T.H. No 4.	0,012	0,085	-0,096	-0,086	-0,027
11. W.H. No 1.	-0,020	0,088	0,141	0,034	-0,014
12. W.H. No 2.	-0,056	-0,065	-0,264	-0,202	-0,225
13. W.H. No 3.	-0,138	-0,046	-0,009	0,029	-0,095
14. W.H. No 4.	0,105	0,098	-0,008	0,047	0,019

TABLE 23
FACTOR MATRICES (ES)

Factors Variables	UNROTATED MATRIX A1				ROTATED MATRIX A1			
	1	2	3	4	1	2	3	4
1. Age.	<u>0,4990</u>	-0,1867	0,1953	-0,2766	-0,3814	0,3019	-0,2849	0,1071
2. Temp.	<u>0,3737</u>	-0,4162	-0,0852	0,2179	<u>0,1194</u>	<u>0,4436</u>	-0,1499	-0,3423
3. Int.	<u>-0,5212</u>	<u>0,2903</u>	-0,0568	-0,2041	0,1176	<u>-0,4570</u>	0,0965	0,3491
4. Sense.	<u>0,1096</u>	0,1441	-0,0374	0,2700	-0,0416	<u>-0,0646</u>	0,1383	-0,2993
5. Feel.	0,1590	-0,0840	-0,2639	-0,1630	0,0463	-0,0301	-0,3557	-0,0306
6. Judge.	<u>0,4257</u>	0,2630	0,1697	-0,2049	<u>-0,5486</u>	-0,0185	-0,1294	0,0313
7. T.H. No 1.	<u>0,3766</u>	-0,2168	-0,0697	-0,2026	<u>-0,0913</u>	0,2177	-0,3451	0,0221
8. T.H. No 2.	<u>0,3414</u>	<u>0,3902</u>	-0,1488	0,1601	-0,2856	-0,2568	-0,0408	<u>-0,3730</u>
9. T.H. No 3.	0,0628	<u>0,0487</u>	<u>0,4565</u>	0,2893	-0,2241	0,2403	0,4683	<u>-0,0915</u>
10. T.H. No 4.	-0,0733	0,0698	<u>-0,0414</u>	-0,0277	0,0044	-0,1256	0,0047	0,0303
11. W.H. No 1.	<u>-0,3566</u>	-0,2579	-0,1967	0,0448	<u>0,5261</u>	0,0838	-0,0384	0,0694
12. W.H. No 2.	<u>0,2387</u>	<u>0,4613</u>	-0,2335	0,0040	<u>-0,2651</u>	<u>-0,4087</u>	-0,1410	-0,2379
13. W.H. No 3.	0,2093	<u>-0,0622</u>	-0,2974	0,0698	0,0931	<u>-0,0179</u>	-0,2423	-0,2614
14. W.H. No 4.	-0,1589	-0,0022	0,2042	-0,1476	-0,0605	0,0309	0,0984	0,2729
	UNROTATED MATRIX A2				ROTATED MATRIX A2			
	1	2	3	4	1	2	3	4
1. Loc.	<u>-0,3545</u>	0,3083	0,0977	-0,0693	-0,0829	-0,3978	0,2423	0,2167
2. D.R.T.	<u>-0,2818</u>	-0,0173	-0,2465	-0,0825	0,2844	<u>-0,2078</u>	-0,1076	0,0947
3. Card Rot.	<u>-0,3826</u>	-0,2312	0,1217	-0,1801	0,2315	0,0993	0,0608	0,3834
4. Let. Set.	<u>-0,4089</u>	0,0163	-0,1269	-0,1794	0,2468	-0,2302	-0,0360	<u>0,2751</u>
5. Inf.	<u>-0,1746</u>	-0,3171	<u>-0,3692</u>	0,0959	<u>0,5165</u>	0,0484	-0,1832	-0,1221
6. Cube. Comp.	-0,2856	-0,2359	<u>0,3834</u>	0,1782	<u>0,1431</u>	0,3078	0,4225	0,1469
7. Fig.Class.	-0,1978	-0,1937	<u>-0,1343</u>	0,0764	0,3184	0,0369	-0,0034	-0,0149
8. Blox.	-0,2682	0,0545	0,1281	0,1541	0,1052	-0,0486	0,2978	0,0340
9. Reason Ab.	<u>-0,4090</u>	-0,1373	-0,1087	0,1262	<u>0,4114</u>	-0,0571	0,1380	0,0393
10. Pat. Compl.	<u>-0,4783</u>	0,2064	0,1017	0,1651	<u>0,1636</u>	-0,2508	0,4020	0,0927
11. Fig. Ser.	<u>-0,2073</u>	-0,0338	-0,0335	0,3088	0,2520	-0,0165	0,2498	-0,1778
12. Com. El.	-0,1878	0,1088	0,1781	<u>-0,3654</u>	-0,1557	-0,1088	-0,0234	<u>0,4472</u>
13. Gott. Fig.	<u>-0,3637</u>	0,0078	-0,0133	<u>-0,1466</u>	0,1730	-0,1492	0,0394	<u>0,2738</u>
14. See. F.	<u>-0,0153</u>	<u>-0,4951</u>	-0,0500	-0,2044	0,2453	0,3446	-0,2655	0,1986
15. Conseq.	0,0351	<u>-0,3646</u>	0,2114	-0,0509	0,0268	<u>0,3701</u>	0,0203	0,1381
16. Qual.	0,1036	<u>-0,3524</u>	0,2960	0,0478	-0,0364	<u>0,4362</u>	0,1148	0,0587

FACTOR CORRELATION MATRIX

	1	2	3	4
1.	1,0000	-0,0347	0,0712	0,1670
2.	-0,0347	1,0000	-0,1002	-0,0310
3.	0,0712	-0,1002	1,0000	0,1367
4.	0,1670	-0,0310	0,1367	1,0000

When comparing the rotated and unrotated matrices a general drop of loadings was observed, as was the case with the Afrikaans speaking sample. Since the factors were again uncorrelated, the unrotated matrices were interpreted.

Factor 1 of both matrices displays a number of substantial loadings on the variables "Age", "Secondary Functioning", "Extraversion", "Judging", T.H. No 1 and W.H. No 1. Also T.H. No 2 has a relatively high loading.

In Matrix A₂ five variables of the Spatial - Reasoning category were represented.

The pattern of these loadings is rather inconsistent. Variables determining "Stability" are merged with those of "Instability" or "Flexibility". Also not all the Spatial or Reasoning tests are loaded on this factor. If one would attempt an interpretation of this erratic behaviour of the variables, one could assume that the English sample used a more versatile and therefore a more varied approach to solve the test problems with the result that in this respect no clear pattern with regard to the problem solving styles could emerge.

In contrast to Factor 1 a very consistent pattern arises from Factor 2. Matrix A₁ comprises "Introversion", "Rigidity in Thinking" and "Rigid Work Performance". These are all determinants of the "Rigidity" polarity of the identified problem-solving style "Rigidity versus Flexibility". Except for the Myers-Briggs "Feeling" variable virtually all

other components of the problem-solving style "Rigidity versus Flexibility" were identified again.

Matrix A_2 shows the extent to which "Rigidity" has a detrimental effect on all "fluency" tests, viz. the "Qualities", "Seeing Faults" and "Consequences" tests. A reflection of the polarities of the problem solving style "Rigidity versus Flexibility" is necessary to facilitate the identification of comparative similarity between the "Flexibility" pole and "Fluency" on which the abovementioned three tests load and to clarify the nature of the influence of this problem-solving style on the test results.

The identification of these interrelations indicates also that the influence of "Extraversion" on test achievements (as found by Brandtstädter (1972)) can be extended in terms of Thinking and Work Habits as already observed with Factor 2 of the first Inter-Battery Factor Analysis.

6.5.3 COMPARISON : AFRIKAANS AND ENGLISH SPEAKING SAMPLES.

The comparison of the Afrikaans and English speaking samples confirmed the previous indications according to which the Afrikaans speaking subjects seem to show a greater consistency in their approach to test problems. These findings are demonstrated with Factor 1 of both samples. The fact that variables T.H. No 2 and W.H. No 2 were clustered together with measures of the "Stability - Instability" dimension (for Afrikaans speaking subjects) tends to support this assumption because of the similarity between "Stability" and "Rigidity" concepts.

To draw further conclusions from these differences would exceed the framework of this study.

7. EVALUATION OF THE RESULTS.

The Thinking and Work Habit rating-scales (as they were developed with the pilot investigation) retained their metrical properties in this investigation and warranted their application to investigate problem-solving styles.

For the identification of problem-solving styles it was necessary to determine the interrelationship between thinking/work habits and personality variables on the one hand and to establish their influence on cognitive functioning on the other hand. In this respect it follows that it was also necessary to prove the relative stability of the problem-solving styles. On the basis of the correlation matrices it was possible to indicate the stable interrelation of the three Thinking Habits "Rigorous versus Digressive Thinking", "Versatility versus Rigidity in Thinking" and "Ideational Conformity versus Ideational Independence" with their respective work habits.

This can partly be attributed to the construction method of the measuring devices themselves. As will be remembered, Working Habits were explicitly inferred from the Thinking Habits in order to determine the extent to which internal processes can be represented as overt behaviour in the work situation of research scientists.

The interrelation between "Daydreaming versus Lack of Daydreaming" and "High versus Low Performance Potential" was insufficient to allow for any firm conclusions.

The selection of personality and cognitive tests, assumed to have a bearing on Thinking and Work Habits, was done in a

more subjective way, due to the exploratory nature of the investigation. Notwithstanding, the factors of the first inter-battery factor analysis led to the identification of problem-solving styles, comprising thinking and work habits - as well as personality variables.

Two styles were identified: "Stability versus Instability" and "Rigidity versus Flexibility". Both the Afrikaans and the English speaking sample displayed a high degree of similarity with regard to their problem-solving styles, but not all of the determinants for these styles were identical in both samples. This indicates that the interrelation between Thinking and Work Habits as well as with the measured personality traits can vary from person to person or from one distinct group to another.

This became quite obvious when contrasting the variables determining the problem-solving styles with cognitive tests as was done with the second inter-battery analyses.

For the Afrikaans speaking sample, two variables of Factor 2 collapsed into Factor 1 which comprised many of the determinants of "Stability versus Instability". This finding cannot be attributed solely to the instability of determinants of the problem-solving styles. It should also be kept in mind that the selection of test variables partially determines the composition of a factor. Since only the common factors from both batteries are extracted, it is possible that we were not entirely successful in selecting those tests which might have a bearing on the specific problem-solving style. It could mean that the sampling of tests may have influenced the outcome rather than anything else. This influence of test sampling on factor compositions has been demonstrated in a study by Jaeger (1966).

The phenomenon of separating formerly interrelated style variables occurred again with Factor 1 in the case of the English speaking sample, but this time no operational definition could be found for the common factor. The only explanation which could be given is similar to French's (1966) assumption, where even on pure factor tests subjects show different approaches to solve the test problems.

The influence of the problem-solving style "Rigidity versus Flexibility" on fluency tests could be clearly demonstrated for the English speaking sample and for some variables of this style with regard to the Afrikaans speaking sample. It could be reasoned that the relatively simple structure of these tests (in comparison to the Space/Reasoning tests) helps to bring out more clearly the influence of this style on the test variables. It also indicates that the structure or organization of a problem-situation (i.e. the test situation) determines relevant variables constituting a given style for obtaining optimal achievement on cognitive tests.

With regard to the stability of the interrelations of the variables determining the problem-solving styles, the application of different factor analytical approaches to the two language groups also revealed some of the peculiarities which were already formulated by Thurstone (1947, p. 360) when stating that "factor loadings cannot be expected to be invariant from one population to a different population".

In addition, it appears that the application of different methods of factor analysis might generate varying results, as was partially demonstrated with the rotated and unrotated matrices.

Some of these shortcomings were reduced by interpreting merely those factors which had loadings above 0,35, thus raising the generally accepted level of interpretability. Additionally, it was stringently avoided to read too much meaning into the factors. Factor 2 of the second inter-battery analysis may serve as an example. The rather high loading on "Ideational Independence" is well combined with "Independent Work Performance" of Matrix A₁ of the Afrikaans speaking sample. They are factorially combined with one of the fluency measures. Since the Thinking and Work Habits were only factorially combined with one other test variable, it was decided to drop this factor rather than attribute too much meaning to it.

The abovementioned shortcomings to the statistical analyses of the results did not affect the significance of our findings seriously. The relative stability of the determinants of problem-solving styles with regard to the two language groups and the confirmation of the findings through the use of different methods of analysis are sufficient proof for the validity of our interpretation.

The results so far also have an important bearing on the method applied to determine thinking and work habits. Their interrelation with other personality and test variables was in most cases interpretable. Particularly the scales "Rigorous Thinking versus Digressive Thinking" and "Rigidity versus Flexibility" with their respective work habits displayed adequate consistencies.

Finally, there is sufficient evidence that the constructed instruments (rating scales) enable testees to develop enough insight into their own thinking and work habits to evaluate them fairly "correctly" by means of self-ratings.

8. CONCLUSIONS AND RECOMMENDATIONS.

In concluding the evaluation of the findings with regard to this study it is necessary to consider the significance of the results for applied psychology, with particular reference to the selection and placement of research workers.

8.1 APPLICATION OF THINKING AND WORK HABIT SCALES.

The application of the Thinking and Work Habit scales in the selection of scientists appears fully justified. In this context the use of the Thinking Habit Scales appears to be particularly suitable since the items are formulated in a "neutral" manner and therefore reducing the chances of testees "faking" their responses. In this respect it is more likely that applicants for research posts would tend to respond to the Work Habit Scales in terms of what they suspect to be desirable "efficient" and undesirable "inefficient" work characteristics of research personnel. In certain cases the results could therefore be biased. The application of Thinking Habit Scales would be sufficient to predict the work habits of testees. The highly significant correlations between the Thinking Habit Scales and their respective Work Habit Scales warrant such an approach.

A further application of the "Work Habit Scales" could, however, be considered by using them for performance appraisal purposes. The items of these scales describe overtly observable work characteristics of scientists, therefore enabling independent ratings, e.g. by superiors, as contrasted to self-ratings. In this respect the application of the "Work Habit Scales" would serve as a criterion against which the performance of scientists can be

assessed.

Further development of similar scales is advisable. Since this was merely an exploratory investigation it would be unjustified to assume that all relevant work habits of research scientists were covered by this study. Further sampling of work characteristics of scientists (e.g. by means of job description methods) may generate additional "Work Habit Scales" of relevance to the effective performance of research scientists.

For the initial application of the scales, it is suggested to exclude the scale "Daydreaming versus Lack of Daydreaming", primarily because of its relatively low inter-correlation with "High versus Low Work Potential".

8.2 PRAGMATIC VALUE OF PROBLEM - SOLVING STYLES.

It is suggested to investigate the use of the major determinants of the identified problem-solving styles as predictors for the selection of research personnel. Judging from the relative stability of the styles it can be assumed that the predictive value of their determinants is high. In this respect it should be noted that particularly the dimensions "Sensing - Intuition", "Thinking - Feeling", and "Judging - Perceiving" of the Myers-Briggs Type Indicator and "Primary - Secondary Functioning" of the Temperament Questionnaire are constantly interrelated with work habits of research workers. This indicates that these personality variables influence the work approach of research scientists to a considerable extent. It is even possible that from a certain intellectual level onwards the work performance is more typically determined by personality traits and thinking habits. In the light of these evaluations it appears absolutely essential to include the abovementioned personality tests (in addition to the Thinking

Habit Scales) in a more comprehensive test battery designed for the selection of research personnel.

Using the determinants of the problem-solving styles as selection measures would have another advantage as well in that the operational definitions of the styles "Stability versus Instability" and "Rigidity versus Flexibility" provide the applied psychologist with a clear frame of reference, described in detail, according to which he can interpret the selection test results.

The problem-solving style "Rigidity versus Flexibility" consists of the personality variable ("Extraversion") and the Thinking and Work Habits ("Versatility versus Rigidity in Thinking", "Versatile versus Rigid Work Performance") are factorially combined with measures of "Fluency" ("Seeing Faults", "Consequences" and the "Qualities" test). In an earlier N.I.P.R. investigation involving C.S.I.R. research personnel (Shapiro, 1968), it was suggested to use a slightly different form of these fluency tests as selection predictors. With this investigation it was confirmed that "fluency" is related to personality traits as well as to thinking and work habits, indicating therefore its importance as a dimension of the research scientist's functioning. In the light of this evidence, it is suggested that fluency tests should be incorporated in the test battery for the selection of research scientists.

In this study the identification of differences in problem-solving styles was only done for the English and Afrikaans speaking subjects. It is recommended that further investigation with problem-solving styles should be done, using different occupational groups of research workers and different age groups. Such studies would assist in generating further information on the stability of the problem solving styles and would also indicate the extent to

which they are characteristic of the occupational level at which a research worker functions and the occupational field in which he operates.

8.3 AGE IMPLICATIONS.

An inspection of the correlation matrices (Table 15 and 17), reveals that the variable "Age" shows significant negative correlations with nearly all spatial and reasoning tests. Within the context of the factor analyses these test variables had negative loadings when combined with the variable "Age". These results confirm the well-known phenomenon that test achievements tend to decline with increasing age. With regard to the tests used in this study this phenomenon was confirmed with a sample of research scientists. For the selection of research workers these findings suggest that different age norms should be applied, as it was done with a variety of "intelligence" tests, e.g. Amthauer's IST, the Wechsler-Bellevue, etc. The application of age norms, however, does not answer the basic and important question, whether "intelligence" declines with increasing age. It would also be premature and dangerous to deduce from the results of this study that the older person is a less effective research worker, particularly when considering Bäumler's (1969) statement, that in academic professions scientific achievements depend largely on the magnitude of knowledge and experience.

APPENDIX I.

THINKING HABITS : QUESTIONNAIRE A

BIOGRAPHICAL DATA

You are kindly requested to fill in all the biographical information asked for.

1. Code Number:
2. Rank (Position):
3. Age:
4. Highest Educational Qualification (Specify):
5. Number of Years Involved in Research (Developmental) Activities:
6. Home Language:
7. Institute:
8. Number of years resident in South Africa:

QUESTIONNAIRE A

1. Code Number:

2. DIRECTIONS:

On the following pages you will find scales containing statements referring to two contrasting methods of thinking or problem-solving attitudes. Between each pair of statements is a line which represents a continuous scale.

Example:

Memorizes names of persons easily.	-----	Has difficulty in memorizing names of persons.
---------------------------------------	-------	--

You are required to make a cross on this line, or scale, indicating which thinking attitude is true of yourself and to what extent. Remember that these statements are sometimes formulated in an extreme manner because they represent the extreme ends of a scale. By making your cross at either of the extreme ends of the scale, you indicate that one or the other thinking attitude described is strongly applicable in your case. By placing your cross more to the middle of the line, you indicate that one of the statements is to some extent true of yourself. Avoid placing too many of your ratings around the centre of the scale however. In certain cases it might be true that you have experienced both methods of thinking which are incorporated in the statements of a particular scale. In such cases, try to decide which method of thinking is more typical of you and make your cross accordingly. This questionnaire is not designed to evaluate "efficient" or "inefficient" thinking styles of research personnel. Therefore do not try to evaluate the thinking characteristics in terms of whether they indicate a "good" or "bad" research worker. Concentrate only on your personal thinking attitudes and try to determine which of the statements describe them best.

Thus, proceed in your scaling as objectively and honestly as possible. Please rate each pair of opposites. Do not omit any of them. Make only one cross on each scale. There is no time limit, therefore think carefully before making a decision. Start with item 1 and work through to the end of the questionnaire without stopping.

1.	Accepts ideas from others with hesitance.		Accepts ideas from others readily.
2.	Seldom experiences periods where no ideas emerge.		Often experiences periods where no ideas emerge.
3.	He seldom becomes absorbed in his fantasies.		He often becomes absorbed in his fantasies.
4.	Is not inclined to become involved in day-dreaming.		Is inclined to become involved in day-dreaming.
5.	Often day-dreams.		Seldom day-dreams.
6.	Own ideas enmesh with those of others.		Own ideas are clearly separated from those of others.
7.	Does not enjoy withdrawing into his fantasies.		Enjoys withdrawing into his fantasies.

8.	Produces ideas on a variety of problems.		Produces ideas on a few problems.
9.	He seldom becomes completely absorbed in his fantasies.		He often becomes completely absorbed in his fantasies.
10.	Grasps new ideas slowly.		Grasps new ideas quickly.
11.	Directs his thoughts in a confident manner.		Has doubts when directing his thoughts.
12.	Seldom experiences periods when no new ideas emerge.		Often experiences periods when no new ideas emerge.
13.	Dislikes adapting own ideas to those of others.		Prefers to adapt own ideas to those of others.
14.	Often changes his mind about a problem.		Seldom changes his mind about a problem.

15. Readily merges own ideas with those of others.		Hesitantly merges own ideas with those of others.
16. He seldom dreams about how to fulfill his wishes.		He often dreams about how to fulfill his wishes.
17. Recognises crucial elements of ideas immediately.		Takes unduly long to recognise crucial elements of ideas.
18. Often changes his ideas regarding the solution of a problem.		Seldom changes his ideas regarding the solution of a problem.
19. Obtains a feeling of well-being when involved in his fantasies.		Does not obtain a feeling of well-being when involved in his fantasies.
20. Ideas emerge suddenly.		Ideas emerge gradually.

21. Seldom changes his mind regarding the solution of a particular problem.

--

Often changes his mind regarding the solution of a particular problem.

22. Experiences brief periods where no new ideas emerge.

--

Experiences long periods where no new ideas emerge.

23. His imagination does not distract him from his original ideas.

--

His imagination distracts him from his original ideas.

24. Experiences difficulty in changing initial ideas.

--

Does not experience difficulty in changing initial ideas.

25. Often day-dreams about his future.

--

Seldom day-dreams about his future.

26. Grasps the essence of new ideas quickly.

--

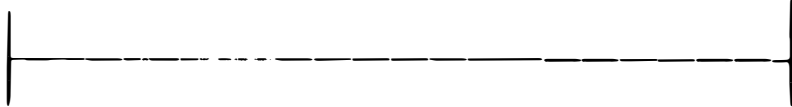
Is very slow in grasping the essence of new ideas.

- | | | | |
|-----|--|--|--|
| 27. | Does not remember former ideas clearly. | | Remembers former ideas clearly. |
| 28. | Is often distracted by others' ideas. | | Is seldom distracted by others' ideas. |
| 29. | Proceeds in a steady manner. | | Proceeds in an unsteady manner. |
| 30. | Develops new ideas without much effort. | | Has to make an effort to develop new ideas. |
| 31. | Has to make an effort to concentrate on problems. | | Concentrates with ease on problems. |
| 32. | Does not restrain himself from changing his initial ideas. | | Restrains himself from changing his initial ideas. |
| 33. | Solves problems by using many methods. | | Solves problems by using few methods. |

- | | | |
|--|--|--|
| 34. Has many ideas in mind at a time. | | Has few ideas in mind at a time. |
| 35. Accepts ideas from others quickly. | | Accepts ideas from others with hesitance. |
| 36. Changes his ideas easily. | | Does not change his ideas easily. |
| 37. Gains much pleasure from withdrawing into his imagination. | | Gains little pleasure from withdrawing into his imagination. |
| 38. Scans easily over details involved in a problem. | | Labours over details involved in a problem. |
| 39. Seldom forgets what he intended doing. | | Often forgets what he intended doing. |
| 40. Often doubts the value of his own ideas. | | Seldom doubts the value of his own ideas. |

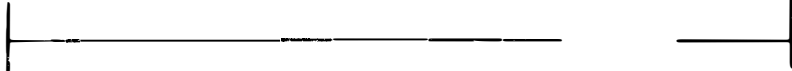
41. Uses his fantasy.		Does not use his fantasy.
42. Enjoys day-dreaming.		Does not enjoy day-dreaming.
43. Defines own ideas clearly.		Definition of own ideas is unclear.
44. Is not inclined to fantasize.		Is inclined to fantasize.
45. Thoughts wander to subjects different to that under consideration.		Thoughts remain on the subject under consideration.
46. Is easily convinced by the ideas of others.		Is not easily convinced by the ideas of others.
47. Produces numerous ideas.		Produces few ideas.

48. Is doubtful when thinking over own ideas.



Is not doubtful when thinking over own ideas.

49. Seldom withdraws into his fantasies.



Often withdraws into his fantasies.

50. Recognises few inadequacies in own ideas.



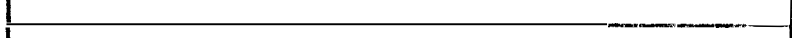
Recognises many inadequacies in own ideas.

51. Develops ideas slowly.



Develops ideas swiftly.

52. Ideas are nebulous.



Ideas are clearly delineated.

53. After having been interrupted he seldom forgets what he had in mind.



After having been interrupted he often forgets what he had in mind.

54. Thoughts follow a strict sequence of arguments.



Thoughts deviate from a strict sequence of arguments.

55. Has clearly defined goals in mind.



Goals he has in mind are somewhat blurred.

56. Seldom has only a vague conception of his ideas.



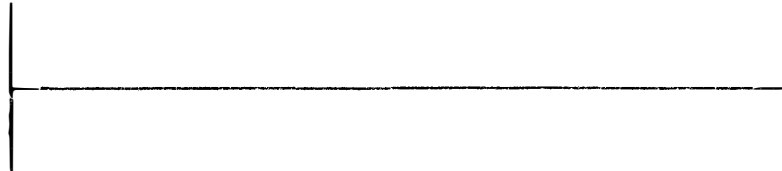
Often has only a vague conception of his ideas.

57. Produces ideas in a facile manner.



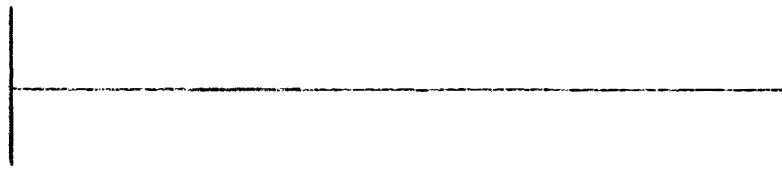
Produces ideas in a laborious manner.

58. Seldom feels that his reservoir of ideas concerning a problem is exhausted.



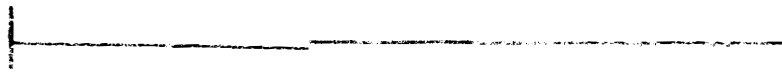
Often feels that his reservoir of ideas concerning a problem is exhausted.

59. After being disturbed he has difficulty in recollecting his thoughts.



Has no difficulty in recollecting his thoughts after being disturbed.

60. Has few ideas in mind.



Has many ideas in mind.

APPENDIX II

WORK HABITS : QUESTIONNAIRE B

QUESTIONNAIRE B.

1. Code Number:

2. DIRECTIONS:

On the following pages you will find scales containing statements referring to work habits of scientists. As in the previous questionnaire you will find that between each pair of statements is a line which represents a continuous scale.

Example:



You are required to make a cross on this line, or scale, indicating which particular work behaviour applies to you as well as the extent to which it applies to you. Remember that these opposites are sometimes formulated in an extreme manner, because they represent the extreme ends of a continuous scale. By making the cross at either extreme end of the line you indicate that one of the two work habits is very appropriate to yourself. By placing your cross more to the middle of the line, you indicate that one of the statements is applicable to some extent in your specific case. However, avoid placing all your ratings around the centre of the line. In certain cases it might be true that you employ both of the opposing working habits. In such instances, try to decide which work behaviour you employ more often and make your cross accordingly. This questionnaire is not designed to evaluate "efficient" or "inefficient" work characteristics of research personnel. Therefore, do not try to evaluate which of the work habits you think indicate a "good" or "bad" research worker. Concentrate only on your personal work habits and try to determine which of the opposite statements describe them best.

Complete the questionnaire as objectively and honestly as possible. Please rate each pair of opposites. Do not omit any of the items. Make only one cross on each scale. There is no time limit, therefore think carefully before making a decision. Start with item 1 and work through to the end of the questionnaire without stopping.

1	Does not enjoy being specialized in some work topics.		Enjoys being specialized in some work topics.
2	Enjoys organizing his work with precision.		Does not particularly enjoy organizing his work with precision.
3	Follows a strict sequence of steps in his research plans.		Does not follow a strict sequence of steps in his research plans.
4	Particularly enjoys drawing up precise work plans.		Does not particularly enjoy drawing up precise work plans.
5	Enjoys hurrying from one task to another.		Does not enjoy hurrying from one task to another.
6	Includes surplus ideas in his research plans.		Does not include surplus ideas in his research plans.
7	Gets so involved in his ideas that he forgets about planning their realization.		Does not get so involved in his ideas that he forgets about planning their realization.
8	Is seldom directed in his research activities by proposals from colleagues.		Is often directed in his research activities by proposals from colleagues.

9. Quality of work varies.		Quality of work remains constant.
10. Is interested in many lines of research at a time.		Is interested in few lines of research at a time.
11. His thoughts are always a few steps ahead of his actual work.		His thoughts are seldom a few steps ahead of his work.
12. Formulates his ideas with ease.		Has difficulty in formulating his ideas.
13. Prepares his arguments briefly before discussion.		Prepares his arguments in detail before discussion.
14. Has a general idea of how to proceed in his work.		Has a precise plan in mind regarding how to proceed in his work.
15. Works quickly.		Works slowly.
16. Closely adheres to his research plans because unforeseen difficulties seldom occur.		Often changes his work plans because of unforeseen difficulties.
17. Always adheres to his original research ideas (plans).		Seldom adheres to his original research ideas (plans).

18. Tackles few problems at the same time.		Tackles many problems at the same time.
19. Does not become confused when confronted with sudden difficulties in research.		Becomes confused when confronted with sudden difficulties in research.
20. Has difficulty when defending own ideas.		Defends own ideas easily.
21. He often imagines projects he would like to do in future.		He seldom imagines projects he would like to do in future.
22. Does not like to draw up very detailed research plans.		Likes to draw up very detailed research plans.
23. Does not ask for help from colleagues when running into difficulties.		Asks for help from colleagues when running into difficulties.
24. Reacts immediately to research problems.		Does not react until problems have been carefully considered.

25. Envisages in great detail his own arguments as well as the likely counter-arguments of others before entering a discussion.

--

Envisages his own arguments roughly as well as likely counter-arguments of others before entering a discussion.

26. Avoids administrative details related to research projects.

--

Does not mind administrative details connected with research projects.

27. Prefers to work according to strict rules.

--

Does not prefer to work according to strict rules.

28. Has no inner convictions as to the worth and validity of his research efforts.

--

Has an inner conviction of the worth and validity of his research efforts.

29. Neglects details involved in his tasks.

--

Attends to all details involved in his tasks.

30. His work needs to be checked for accuracy.

--

His work does not need to be checked for accuracy.

31. Research interests lie within a wide range.

--

Research interests lie within a narrow range.

32. Enjoys being involved in a variety of tasks at one time.

Enjoys being involved in few tasks at one time.

33. Prefers to go his own ways in research.

Does not prefer to go his own ways in research.

34. Does not rush his work.

Rushes his work.

35. His thoughts seldom deviate from the work at hand.

His thoughts often deviate from the work at hand.

36. Adheres to his original research design in spite of proposals from others.

Proposals from others distract him from his original research design.

37. Is poorly informed about others' research projects.

Is well informed about others' research projects.

38. Has vivid conception of the projects he will tackle in future.

Has no vivid conception of projects he will tackle in future.

39. Is untidy and disorderly in his working habits.		Is neat and orderly in his working habits.
40. Enjoys organizing his research activities.		Does not enjoy the organizing aspect of research activities.
41. Has a variety of research interests.		Has few research interests.
42. Perseveres when working on a difficult problem until it is solved.		Does not persevere when working on a difficult problem.
43. Prefers a slow tempo of work.		Prefers a quick tempo of work.
44. Often misplaces items.		Seldom misplaces items.
45. Prefers to rely on advice from colleagues when starting a new project.		Does not prefer to rely on colleagues' advice when starting a new project.

46. His thoughts seldom deviate from the work he is doing.

His thoughts often deviate from the work he is doing.

47. Often interrupts his work to relax.

Seldom interrupts his work in order to relax.

48. Is well informed on subjects other than his research speciality.

Is uninformed on subjects other than his research speciality.

49. Diagnoses strong and weak points in a research programme quickly and accurately.

Has difficulty in diagnosing strong and weak points in a research programme.

50. Is slow in discussions.

Is quick in discussions.

51. Often tries to get his work done as quickly as possible.

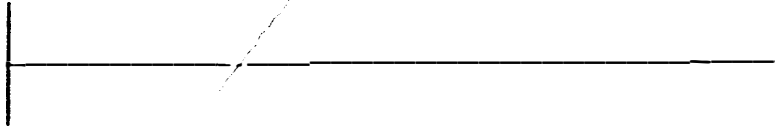
Seldom tries to get his work done as quickly as possible.

52. Often doubts that he is fully suited for research activities.

Seldom doubts that he is fully suited for research activities.

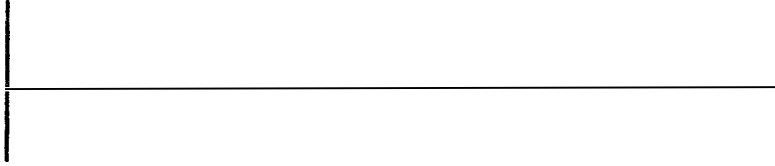
53. Does not adhere too strongly to details in his research activities.		Adheres strongly to details in his research activities.
54. Easily detaches his thoughts from one task in order to concentrate on another.		Has difficulty in detaching his thoughts from one task in order to concentrate on another.
55. Relies on himself when running into difficulties in his work.		Relies on help from others when running into difficulties in his work.
56. Often relaxes during work.		Seldom relaxes during work.
57. Adapts to others in research.		Does not adapt to others.
58. Plans his work accurately.		Plans his work carelessly.
59. He is a team worker.		He works alone.
60. Thoughts seldom exceed the present problems involved in a project.		Thoughts often exceed the actual problems involved in a project.

61. Has difficulty in formulating his ideas and thoughts concisely and clearly.



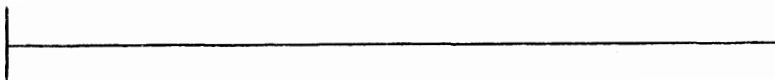
Formulates and communicates his ideas and thoughts concisely and clearly.

62. When confronted with unexpected problems, he quickly devises ways and means of overcoming them.



When confronted with unexpected problems, he slowly devises ways and means of overcoming them.

63. Enjoys jumping from one task to another.



Enjoys concentrating on one task.

64. Is enthusiastic about his work.



Is not enthusiastic about his work.

65. Others detect shortcomings in projects faster than he does.



Others do not detect shortcomings in projects faster than he does.

66. When planning his research activities he relies on himself.

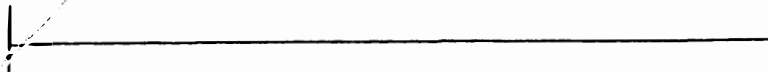


When planning his research activities he relies on advice from others.

67. Becomes confused when defending own ideas.		Does not become confused when defending own ideas.
68. Seldom thinks about future research projects.		Often thinks about future research projects.
69. Solves problems by working them out on his own.		Solves problems by discussing them with others.
70. Seldom comes up with really new ideas or suggestions.		Often comes up with new ideas or suggestions.
71. Often considers changing his job.		Seldom considers changing his job.
72. Plans his projects and activities with great care.		Planning of projects and activities lacks care.
73. Often doubts the value of his contributions.		Seldom doubts the value of his contribution.

74.	Has to re-read articles often in order to understand them.		Seldom has to re-read articles in order to understand them.
75.	His research plans lack detail.		His research plans are detailed.
76.	Gets few ideas from discussions with colleagues.		Gets many ideas from discussions with colleagues.
77.	Is not a research perfectionist.		Is a research perfectionist.
78.	Is interested in the research projects of others.		Is not interested in the research projects of others.
79.	New ideas do not emerge while he is relaxing.		New ideas emerge when he is relaxing.
80.	Often intends to give up a project.		Seldom intends to give up a project.

81. Likes to obtain opinions from colleagues.



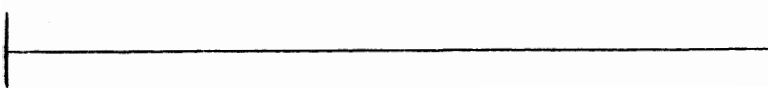
Is not interested in the opinions of colleagues.

82. Relies on proposals from colleagues.



Does not rely on proposals from colleagues.

83. Often thinks that he could do better on other projects.



Seldom thinks that he could do better on other projects.

84. Seldom changes his mind about his research plans.



Often changes his mind about his research plans.

APPENDIX III

ADDITIONAL ITEMS INCLUDED IN

QUESTIONNAIRE B.

ADDITIONAL ITEMS INCLUDED

IN

QUESTIONNAIRE B.

SCALE NO 4

Item No of
Questionnaire

- 73 Often doubts the value of his contributions-
Seldom doubts the value of his contributions.
- 78 Is interested in the research projects of others-
Is not interested in the research projects of others.
- 80 Often intends to give up a project-
Seldom intends to give up a project.
- 83 Seldom thinks that he could do better on other projects-
Often thinks that he could do better on other projects.
- 56 Often relaxes during work-
Seldom relaxes during work.
- 52 Often doubts that he is fully suited for research
activities-
Seldom doubts that he is fully suited for research
activities.
64. Is enthusiastic about his work-
Is not enthusiastic about his work.
65. Others detect shortcomings in projects faster than he
does-
Others do not detect shortcomings in projects faster
than he does.
67. Becomes confused when defending own ideas-
Does not become confused when defending own ideas.
71. Often considers changing his job-
Seldom considers changing his job.

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Handwritten signature and date: *Witkin* 1970

