

comparisons were made. Those subjects who received a Dudec of eight or more (the poorest performers) seemed, on the basis of raw data, to do much better in the experimental group sample. However, statistically, there was no difference in the degree to which they improved ($t=1,325$) compared with the same sample in the control group.

The subjects who performed above average on the CTB, receiving a Dudec of five or less, also showed no significant difference ($t=0,43$) in improvement between groups.

The correlation coefficients were found for the ten variables of each group (see Appendix D). The standard deviation of the correlation coefficients is $s=1/\sqrt{N-1}$, which in this case equals $1/\sqrt{99}$, which equals 0,101. A correlation coefficient r is significantly different from zero at the 0,05 level if $z=r/s$ is greater than 1,96 or if r is greater than 0,20, i.e. ($1,96 \times 0,101$).

Of primary interest was the fact that age did not seem to affect the other variables significantly (all correlation coefficients were less than 0,20 for the control group and all but one coefficient were less than 0,20 for the experimental group). For the experimental group, to a very small extent, age did seem to be positively correlated with the pre-test pattern reproduction score. More testing is necessary to give more conclusive evidence that this correlation is actually in operation.

Also of interest is the correlation of education to all the other variables except that of age. The correlation coefficients were found to be greater than 0,20 for both groups. Variables three and seven (the Dudecs) show a negative correlation because a score of one is the best score, while a score of twelve is the lowest.

For both groups a high correlation coefficient was found between the pre-test Dudec and the post-test Dudec ($r>0,20$). In addition, the sub-tests are all positively correlated with each other (all $r's>0,20$).

The pattern reproduction test and the circles test are more closely related to each other than either of them is to the form series test. This is true for both groups.

3.2 Results of the Checklist

Twelve shiftbosses completed the checklist. They were chosen by the assistant mine manager. The first group of six shiftbosses had in their gangs two or more subjects from the control group, and the second group of six had in their gangs two or more subjects from the experimental group. The checklist was administered to them by the author.

The shiftbosses completed the checklists three months after the subjects had completed their training programme. The subjects had worked for the same shiftboss for the entire three-month period. Therefore it was assumed that the shiftbosses had a fairly accurate idea of how well the subjects performed their tasks underground. The shiftbosses were not told from which group their subjects came.

For the control group the first group of six shiftbosses reported on a total of eighteen subjects. For the experimental group the second group of six shiftbosses reported on a total of seventeen subjects. Thus, a sample of seventeen and a half per cent of all subjects was taken to find whether the experimental group performed their jobs underground better than the control group.

The actual data of the checklist will be found in Appendix C, along with a copy of the checklist itself in Appendix A. It will suffice here to show and compare the average results of the two groups. Because the samples were fairly small, it was considered better to compare the two groups verbally rather than to try to apply rigorous statistical procedures which mean little under these circumstances.

Before completing the checklist the shiftbosses were asked what they thought of Malawians in the work situation. In general, compared to other ethnic groups, what were their opinions of this group of Africans? In this way a cursory check was made to see whether the two groups of shiftbosses were similar (see Appendix B). If one group disliked Malawians and the other group liked working with them, the first group would, of course, have given lower scores on the checklist.

It can be said, from the answers to that question, that the two groups were similar. Two shiftbosses in each group thought Malawians were, in general, rather difficult to get used to. These four shiftbosses said that the Malawians generally were not up to the standard of other labourers after training and took longer to learn their jobs underground. They all agreed, however, that once the Malawian labourers learned their jobs they were fair workers, but generally not very good workers.

One shiftboss in each group was of the opinion that there was no real difference between Malawians and other ethnic groups. These two shiftbosses said that the labourers were all the same; they all took some time to get used to the job, but then they performed their jobs fairly well.

Two more shiftbosses in each group said they liked Malawians better than the others, although for various reasons. One said he liked Malawians because their contracts were longer, so that he could get better acquainted with them and could work better with them. Another said that Malawians were more intelligent, while a third thought they were more loyal and reliable. The fourth shiftboss said they retained what they learned and worked better than other labourers, always trying to better themselves.

The last shiftboss in each group differentiated between the Malawians themselves, and spoke of two groups of Malawians. They said that 50 per cent were the same as other labourers, doing a fair job when they finally learned how to do it. However, the other 50 per cent they considered better than average, learning quickly and trying for promotion.

It was considered that the two groups of shiftbosses were similar enough to allow one to view the results of the checklist with some reliability. The shiftbosses could give a score from one to five to the subjects they rated, one being the highest score and five the lowest.

The first question asked was how long it took the subject to understand how to do his job. The shiftbosses of the control group reported an average score of 4,2, or slightly more than two months, while shiftbosses of the experimental group reported an average score of 2,4, or from two to four weeks. It seems plausible to say that the experimental group improved a great deal in the average time it took them to learn the job.

The second question asked was how well the subject performed his job. The control group scored an average of 2,9, slightly below average, and the experimental group scored 1,7, rather better than average.

The third question asked was how well the subject understood the orders given by the shiftboss. Again the control group scored much below average at 4,2, while the experimental group scored 1,8, or fairly well.

The fourth question put to the shiftbosses was how long it took the subjects to understand the instructions given in Fanakalo. The average score for the control group was 4,1, or slightly more than two months, while that for the experimental group was 2,3, or slightly more than two weeks.

Question number five inquired whether the subject had been injured during the first three months. The majority of the control subjects had

been injured, while the great majority of the experimental subjects had not been injured.

Question number six gave an indication of the number of times the subjects were injured during the first three months. The control group subjects, on average, were injured once each during three months, while the experimental sample, on average, were practically never injured.

In question number seven it was found that the control group subjects who were injured missed slightly less than one day per injury, and this control group as a whole (eighteen subjects) missed about ten days of work in the first three months due to injuries. Although a few experimental subjects were injured, no shifts were lost due to injuries.

Question number eight indicated that virtually none of the subjects caused accidents which injured others. Thus, what injuries there were were all self-inflicted.

Questions nine, ten and eleven were similar but were related to illness rather than to injury. On average, each of the subjects in the control sample was sick once during the three months and missed one day of work due to that illness. The experimental subjects, on the other hand, almost never missed work due to illness during that time.

Neither group lost time for any other reason, as shown in questions twelve, thirteen and fourteen.

Question fifteen indicated whether or not the subjects took notice of the safety signs and obeyed them. This was followed up in question sixteen, in which the shiftbosses indicated the kinds of unsafe behaviours engaged in by the subjects. In general, the control subjects seemed less inclined to take note of safety signs than the experimental subjects. This seems to confirm the findings in the comparative number of injuries found in the two groups. The unsafe behaviours indulged in by the control group were the failure to wear gloves or hard hats in particular.

In addition, they occasionally misused pieces of equipment which resulted in finger injuries or cuts on their arms. Some experimental subjects were said to take off their hard hats on occasion, but in general they were found to obey safety signs quite conscientiously.

9.3 Some Reinforcement and Learning Curves

There was some additional information accumulated during the study which is presented in this section in graph form.

During the training period a list was kept of all the words presented to each group. The graph in Figure 9.4 shows the cumulative number of words introduced to each group. The control group, at the end of its training programme, had sixty-one Fanakalo words in its repertoire with which to carry on conversations. The experimental group, at the end of three days, had one hundred words to use in conversation. At the end of their training period (five days) they had one hundred and ten words, in addition to being able to use them in sentences.

This graph gives an indication of the possible number of words the subjects of the two groups could learn. There is no evidence here that they did learn that many words, or that they did not learn more words, outside the training programme, than these. What is of interest is that the experimental subjects had an opportunity to learn a greater amount of material than the control group in the same time.

An indication of the possible number of different commands to be followed and questions to be answered by the two groups is shown in Figure 9.5. There was a possible total of forty-five commands which could be followed and questions which could be answered by the control group. Each could be followed a number of times.

The experimental subjects had a possible one hundred and twenty-one commands to follow or questions to answer. What is of interest is again the greater opportunity the experimental subjects had of learning the Fanakalo language.

The number of reinforcements given to one class of ten experimental subjects is depicted in Figure 9.6. They were given one cent pieces and cigarettes interchangeably. To get an idea of the total number of reinforcements given to the entire group of experimental subjects, one need only multiply these numbers by ten (total of 170 in experimental group).

What is of interest here is the sharply decreasing number of reinforcements given per day, although the number of responses required per reinforcement was being increased.

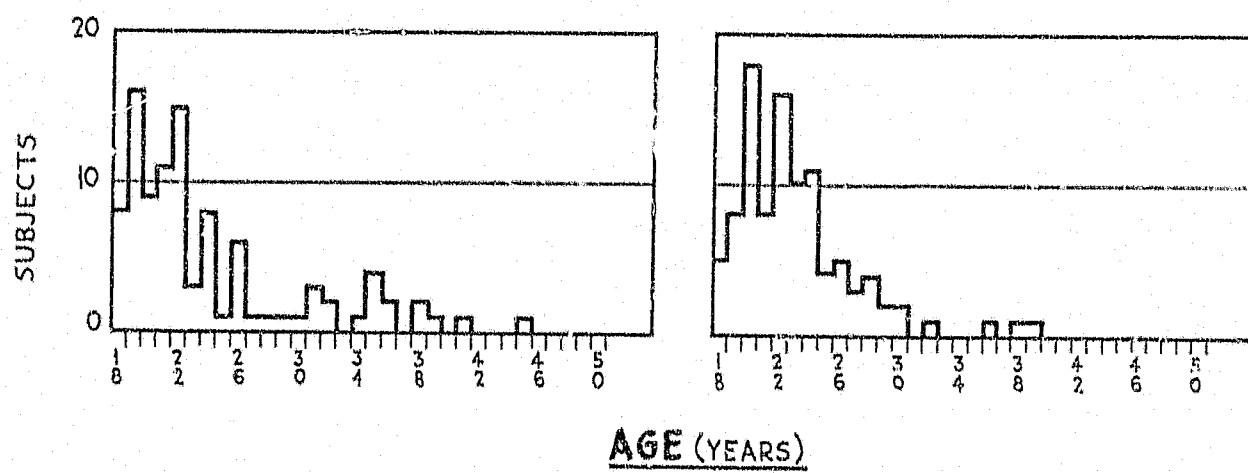
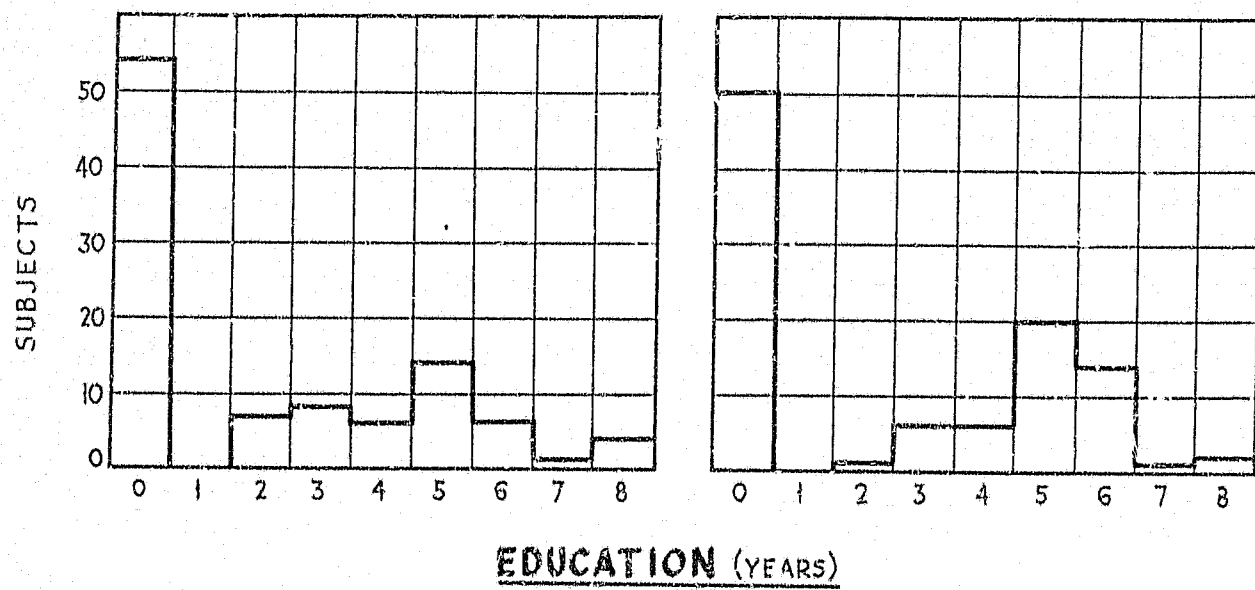
An indication of the actual words learned, and it must be remembered that it is only an indication, is given in Figure 9.7. This is reflected by the number of commands followed and questions answered by one class of ten subjects from each group in a week. Again, multiplying these results by ten will give an idea of the expected results for the entire experimental group, and the entire control group.

It can be seen that, on the whole, the experimental group achieved a larger repertoire of language behaviour than did the control group, even when considering the first three days of both training periods only.

In Figure 9.8 we have a comparison of Figure 9.6 with the data for the experimental group class in Figure 9.7. This shows that, although the number of reinforcements per response are decreased and are finally dispensed with entirely, the subjects continue responding at a high rate. This is most interesting as it is in conflict with the conclusions of other researchers (McGuigan and Lumsden, 1975).

It has been concluded that other reinforcing conditions are probably in operation by the fourth day of training. By that time the subjects realise that a knowledge of Panakalo will help them socialise and gain promotion in their work.

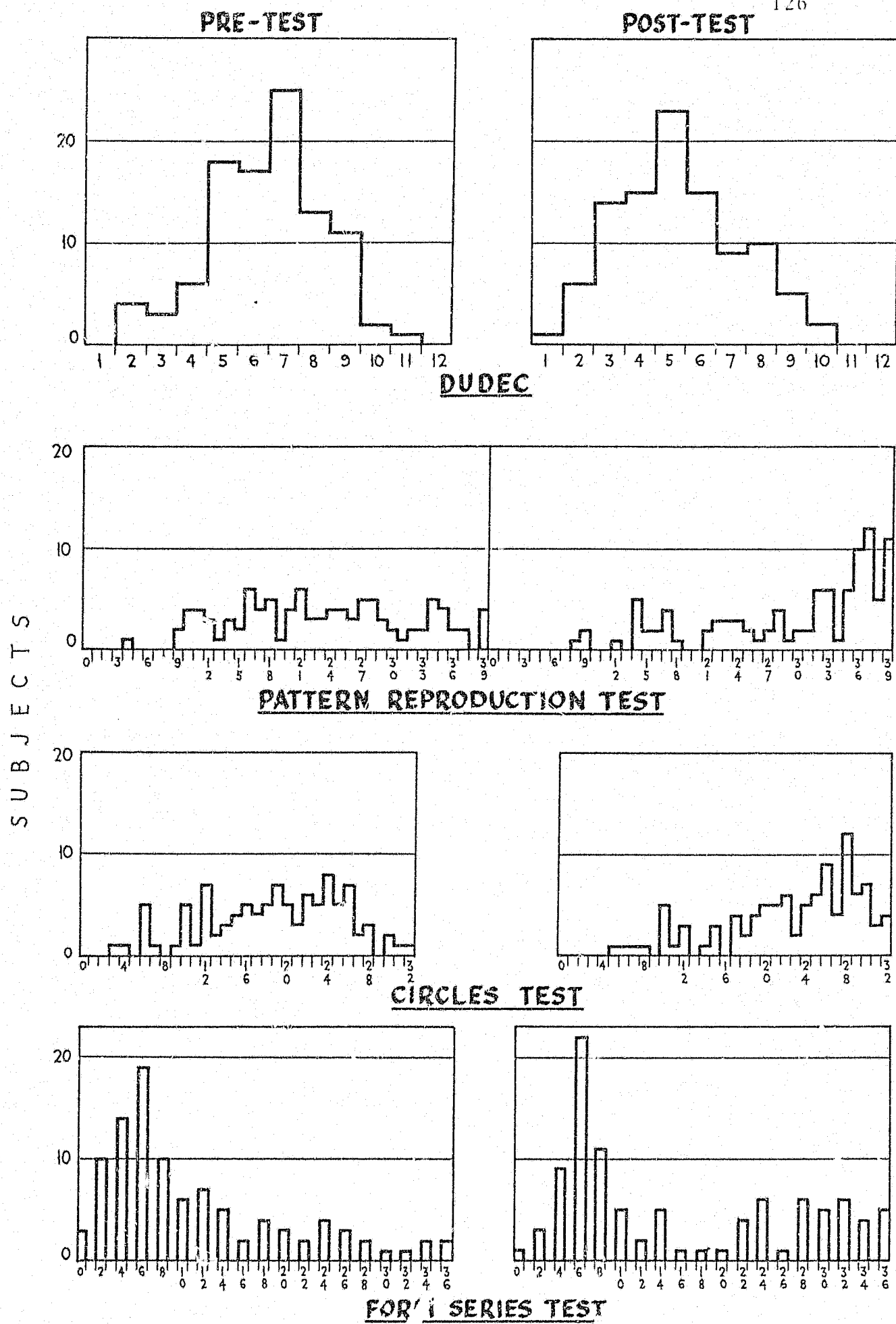
These results will be discussed, in relation to the theory presented previously, in the following chapter.



CONTROL
GROUP
(100 SUBJECTS)

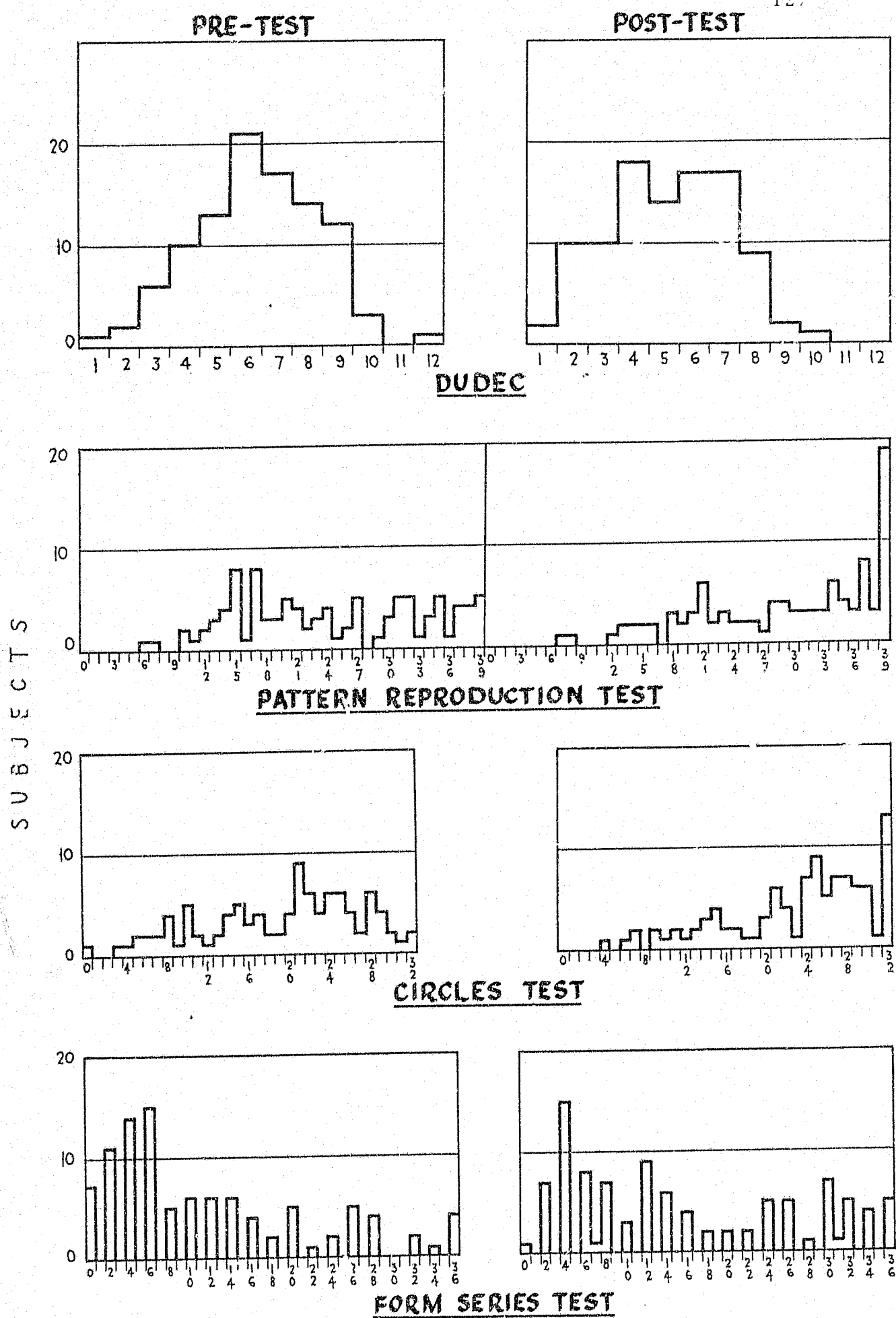
EXPERIMENTAL
GROUP
(100 SUBJECTS)

FIGURE 9.1



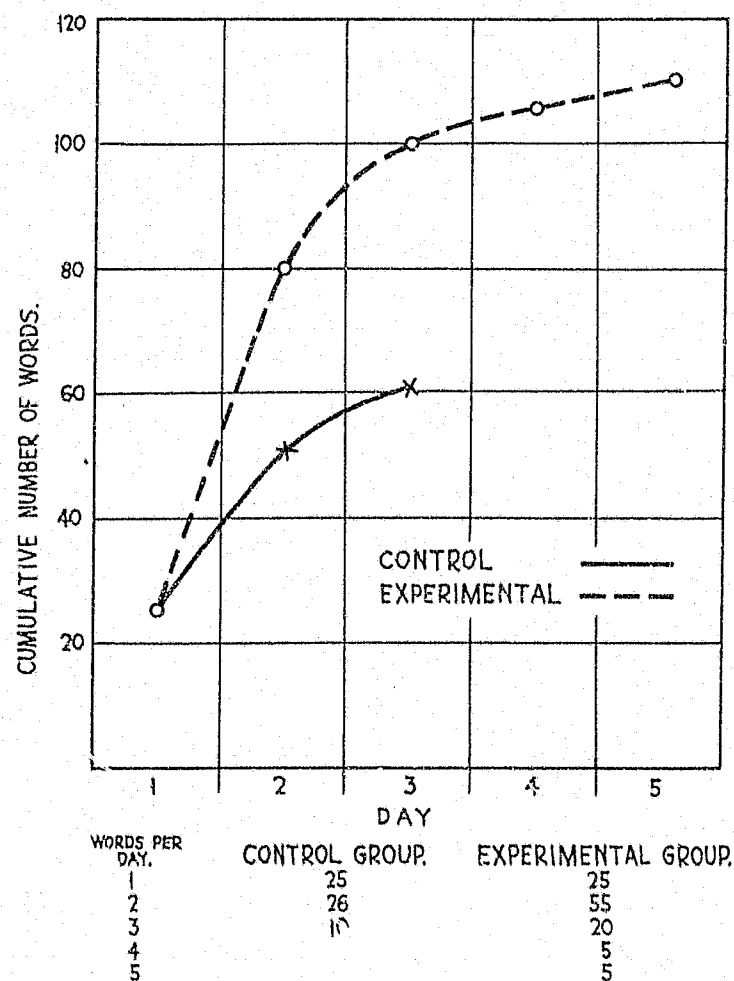
PRE-TEST AND POST-TEST RESULTS FOR CONTROL GROUP.

FIGURE 9.2



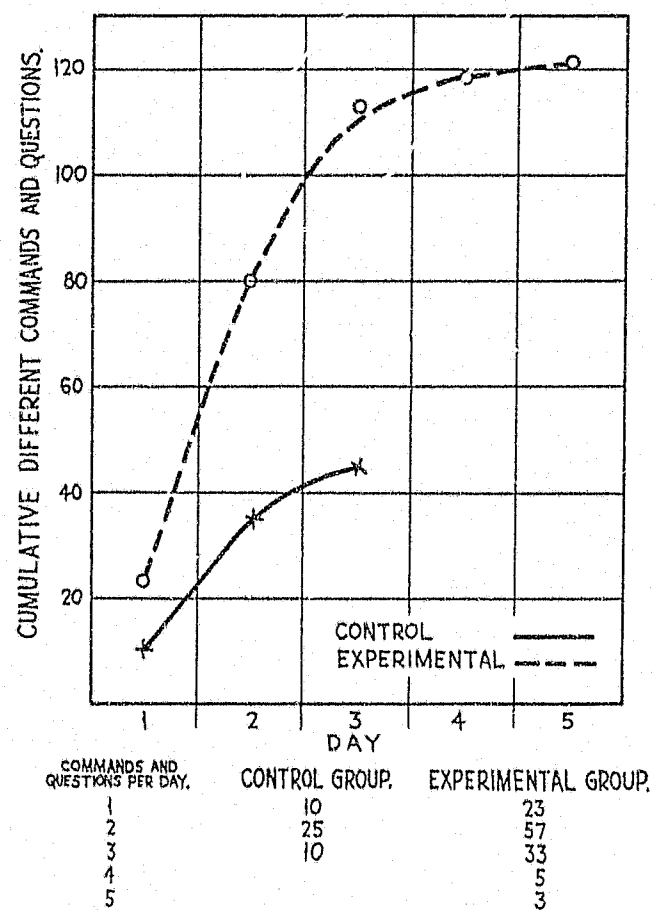
PRE-TEST AND POST-TEST RESULTS FOR EXPERIMENTAL GROUP

FIGURE 9.3



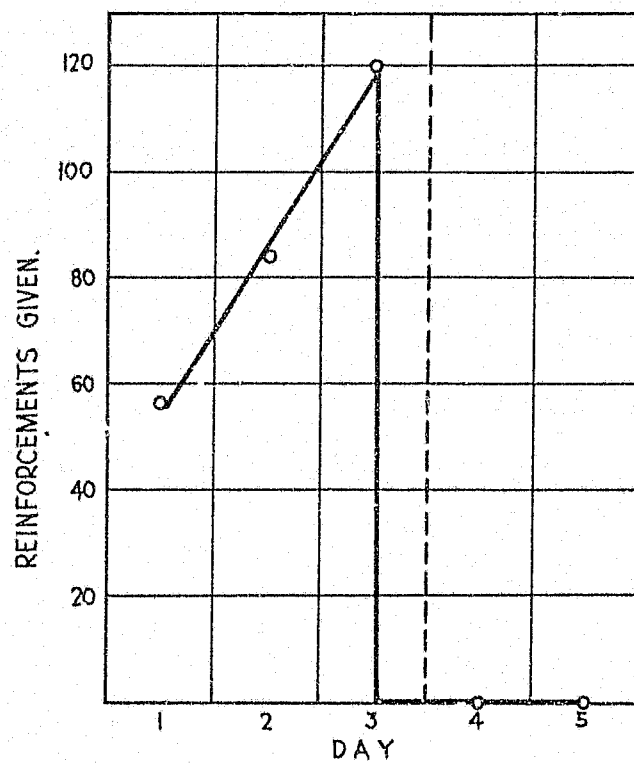
AN INDICATION OF THE POSSIBLE NUMBER OF WORDS LEARNED PER DAY.

FIGURE 9.4



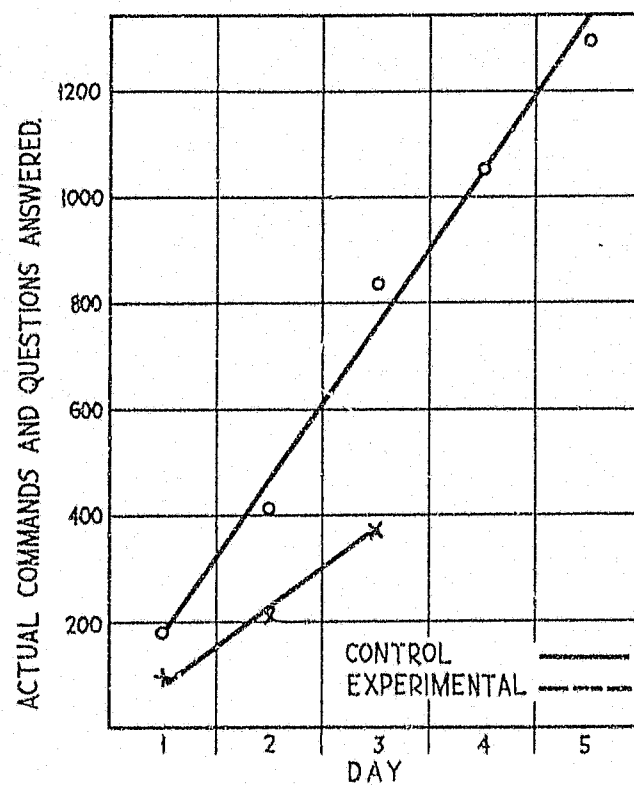
AN INDICATION OF THE POSSIBLE NUMBER OF COMMANDS AND QUESTIONS TO BE LEARNED PER DAY.

FIGURE 9.5



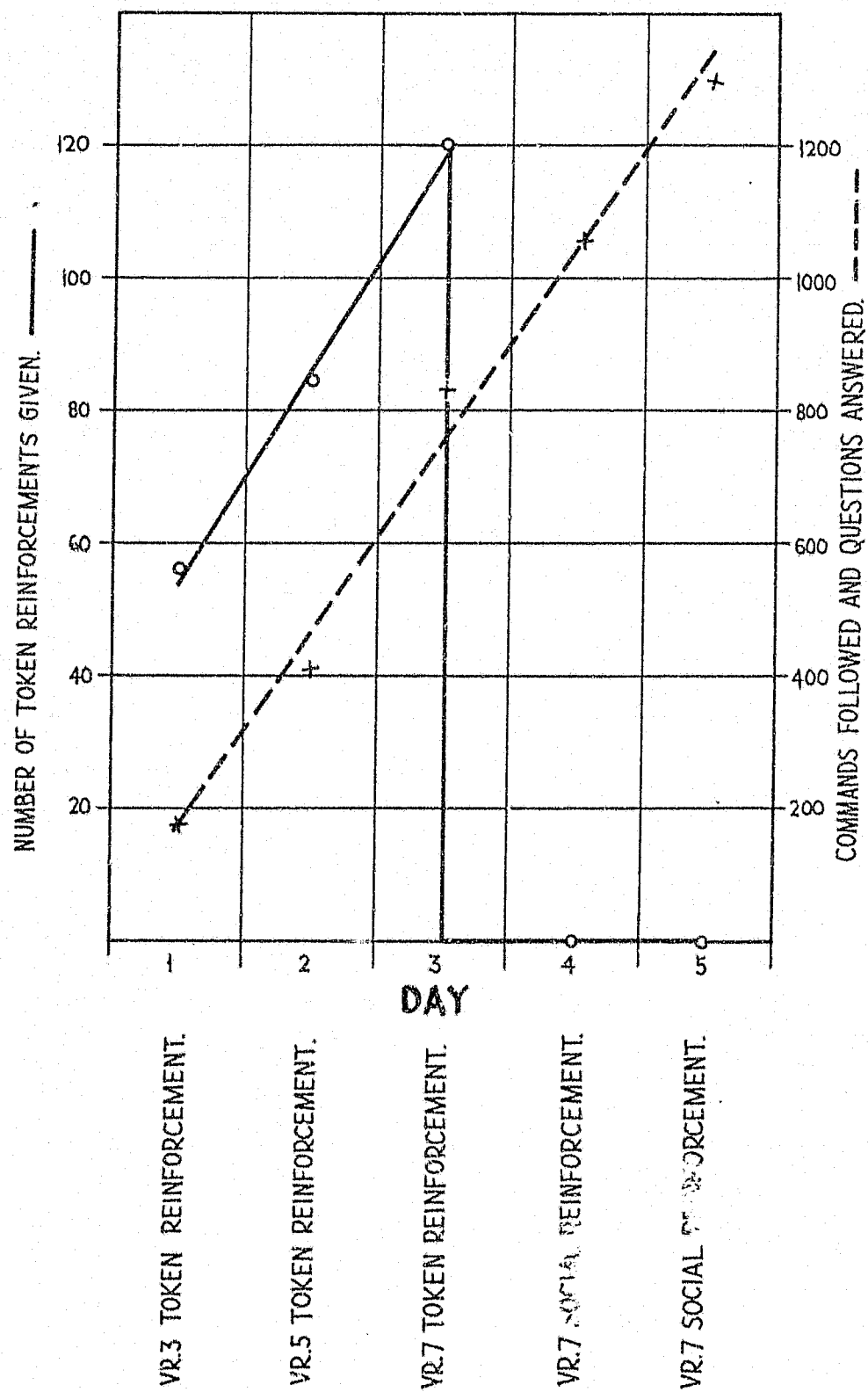
REINFORCEMENTS GIVEN TO ONE CLASS OF TEN SUBJECTS FROM THE EXPERIMENTAL GROUP

FIGURE 9.6



ACTUAL NUMBER OF COMMANDS FOLLOWED AND QUESTIONS ANSWERED BY CLASS OF TEN SUBJECTS FROM EACH OF GROUPS.

FIGURE 9.7



COMPARISON OF NUMBER OF TOKEN REINFORCEMENTS GIVEN WITH
ACTUAL NUMBER OF COMMANDS FOLLOWED AND QUESTIONS
ANSWERED BY ONE CLASS OF TEN SUBJECTS FROM
THE EXPERIMENTAL GROUP.

FIGURE 9.8

10 DISCUSSION AND SUMMARY

The results which were presented in the previous section are now examined more closely. It is necessary to discuss the reasons for the divergent findings of the two test measures. It is also of interest to discuss what the test results indicate for the future perceptual-motor (P-M) training of adults. Some methodological errors will also be discussed.

10.1 A General Review of the Results

The results showed that the two samples were similar. The ages of the control subjects were not significantly different from those of the experimental group, and the levels of education for the two groups were also very similar. Because there were so many subjects who had no education at all, it was felt that these uneducated subjects could have been affecting the results. It was possible that the groups were not as similar as they seemed because of the education variable. As a test, the subjects with no education were deleted from the sample. It was still found that the groups were matched for the level of education, when considering only those who had been to school.

On the pre-test of the Classification Test Battery (CTB) the subjects were also found to be similar. There was no significant difference between groups for the test as a whole, nor for any of the three subtests. Therefore, in general, it can be said that the two groups were well matched over several variables, including country of origin and experience in the mining industry.

Two different training procedures were then used, one for each group. The control procedure was similar to that used on all gold mines on the Witwatersrand. That is, the subjects were prepared for underground work by having to memorise a few phrases, and the names for all the tools.

The experimental procedures involved teaching the subjects the same information necessary for work underground by means of behaviour modification techniques introduced by the author. Cigarettes and one cent pieces were used as token reinforcements on various schedules, in addition to social reinforcement techniques. Motoric exercises were used as reinforcements and also as an aid in teaching better perceptual-motor behaviours.

To determine whether or not the experimental group did improve in regard to the target behaviours two test measures were employed. The CTB was administered a second time to determine if a significantly different result would be noted between groups. In addition, a checklist, which had been drawn up by the author, assessed the on-the-job behaviour of the two groups.

The results show that both groups improved significantly on the post-test CTB compared to the pre-test, but that there was no significant difference between the groups on the post-test. This seems to show that the experimental procedure had no effect on the learning of perceptual-motor data in the experimental group. However, as noted previously, it was thought that this test may be too sophisticated a method to test the hypothesis of this study. Therefore, a second measure, the checklist, was used as a check on the CTB.

The checklist tapped the subjects' supervisors' views on how well the subjects attained the targets of the study. The items on the checklist did not measure specific P-M behaviours but rather general behaviours. Knowing the level of a subject's performance in certain general areas gives a good indication of his perceptual-motor behaviour.

The results of the checklist allow one to say with a fair degree of certainty that the experimental group performed much better in the work situation than did the control group. Since the two groups were shown to

be statistically alike, and only the training procedures were varied, it can be said from the results of the checklist that the experimental procedure seemed to affect those subjects positively.

The conflicting results must now be discussed and put into perspective. How is it possible to get two such divergent results? What do these results mean? Can one say that the experimental group showed an improvement? If so, why?

10.2 An Evaluation of the Test Results

10.2.1 The Classification Test Battery

It was noted earlier that the Classification Test Battery (CTB) may be too sophisticated to measure the differences which were expected to be found using the behavioural training procedures. That is why two measures were used to test the difference between groups. It does seem, from the results, that that may have been the case.

The CTB is the test that is used on the mines for the African population and, thus, lent itself for use in this study. However, too little information was available at the outset of the study regarding the re-test reliability of the CTB. It has become apparent, in the light of more recent information, that the CTB was a poor choice for the purposes of the study. Investigation of the re-test reliability of the CTB by the National Institute for Personnel Research of the Council for Scientific and Industrial Research was done only after the present study was already far advanced.

Four groups of African novices from outside the borders of South Africa were extensively tested by Verster (1974). All four groups were tested initially on arrival at their respective mines. Group A was then tested after three, six, nine and twelve months; Group B after six, nine and twelve months; Group C after nine and twelve months; and Group D after twelve months only. She found that the subjects improved significantly

on re-test, the magnitude of increase in score being the same regardless of the time interval between tests.

The scores for each group increased with multiple exposure until a plateau was reached, conforming to the classic acquisition curve. The subjects were continuing to work underground during the intervals between tests, so the results reflect an interaction between mining experience and multiple test exposure. However, statistical procedures carried out showed that the effect of mining experience was negligible. It seemed that multiple test exposure was the significant factor affecting the results.

On reviewing this information, it would seem that the subjects should have been tested four or five times on the CTB to establish a baseline. Lawrence (personal communication) says that daily testing gives the same results as testing at three-monthly intervals. Thus, the test could have been administered every morning of their training period, and a basal level arrived at before the post-test was administered. A still higher result could then have been expected for the experimental group, while the control group could have been expected to show no higher scores than their baseline.

This, however, would have been impractical. The object of the study was to shorten the period of training, while making it more effective, by reinforcing a greater amount of perceptual-motor behaviours. To carry out the above experimental model would have greatly lengthened the experiment by taking the subjects away from training for half the day every day, although as a research project it might well have been worthwhile.

It seems, then, that the choice of the CTB as a measure to test the differences between groups after differential training, used as it was in this study, was a poor choice. Unfortunately the test/re-test reliability was not known when the study was begun.

It was fortunate that another measure was developed with which to evaluate the effectiveness of the procedures.

10.2.2 The Checklist

The checklist was designed by the author to find out, from those in closest contact with the subjects, to what degree the subjects had actually attained the target behaviours. On this measure, the experimental group showed considerable improvement over the control group.

This measure seems to be the most pertinent to the study. In behavioural literature this question of evaluation has been tackled more thoroughly than in most other psychological orientations, and it is stated that it is only important to test the efficacy of one technique in one situation for one specific sample (Bandura, 1969). In fact, it is only possible to evaluate therapy in that way.

One reason for setting up target behaviours at the beginning of therapy is to have something against which to measure improvement at the termination of that therapy.

Usually it is the therapist and patient or patients who decide whether or not the targets have been reached, to what degree, and whether it was a satisfactory outcome. In an experimental study it is necessary, however, to rule out, as much as possible, personal bias. Therefore, those people in closest contact with the subjects were interviewed.

The shiftbosses knew nothing of the experimental procedures which had gone on above ground in the training centre. They only knew the effective working behaviours of those subjects who worked with them underground. The shiftbosses were questioned only on that information, which, it was expected, they would know best.

One point must be mentioned which may be considered a methodological error. The shiftbosses were interviewed by the author, and it is well known that experimenter bias can enter into such interactions (Rosenthal,

1963 and 1968). However, it must also be pointed out that the shift-bosses did not know anything about the experiment. They were chosen by the Assistant Mine Manager merely to report on specific labourers, not knowing for what particular purpose.

The use of the checklist in addition to the CTB was a natural choice in view of the behaviour modification orientation of this study. It has become clear that the most promising results of this study come from the results of the checklist. Unfortunately it was not expected, prior to the experimental procedure, that the checklist would show results so different from those of the CTB. The checklist was meant to be only an additional indicator of probably similar results. Thus, only 17½ per cent of the two groups was sampled regarding their underground behaviours.

To have results which could stand on their own and be analysed statistically it would have been necessary to interview the shiftbosses of all the subjects. As this had not been planned, it would be somewhat difficult to trace all the subjects once they had been underground for three months, and whose progress was not being monitored by their supervisors. However, it would be possible, and in any further study would be the method of choice in determining any improvement.

It is therefore not possible to point to any conclusive evidence showing that behaviour modification improves the perceptual-motor behaviours of adults. Basically the failure has been in the methods employed to evaluate the procedure.

The evidence from the checklist does point in the direction of a positive effect from the behavioural training procedures. In effect, the experimental group showed that they performed better in general areas of their jobs, and, knowing they can do better in those areas, implies that they have a better background of perceptual-motor

behaviours. This improvement seems to be due to the training procedures introduced by the author, that is, reinforcement of the perceptual-motor behaviours necessary for work underground.

It can be said that there appears to be some evidence to show that, by using behaviour modification, one can improve the perceptual-motor problems of adults. This must be tested further using different population groups with perceptual-motor deficits. It is felt, however, that the results will be similar for any group of such adults. It is only necessary that the evaluation of results be carried out fully.

10.3 An Evaluation of the Study

If one concedes that there was improvement shown in the experimental sample, it remains to be asked what it was about the behaviour modification of that perceptual-motor behaviour that gave such a result. It is only possible to put forward and discuss the probabilities for the efficacy of behaviour modification here, as the evidence is not sufficiently conclusive.

It does seem, however, that the situation was analysed correctly, the major problem discovered, and that proper techniques were employed for solution of the problem. There has been little improvement noted previously with most adults who underwent therapy for perceptual-motor problems. For example, Saunders and Barker (1972) seemed to aim at merely eradicating some difficulty with reading instead of finding out where the reading problem stemmed from.

To search for the root problem first would seem to be the basic necessity of any therapy. It is the explicit basis in behaviour therapy. Reading, for example, is analysed and shown to be a skill derived from perceptual and motor abilities (Dunsing, 1963). Taylor's (1963) account of perceptual development gives, in detail, the analytical breakdown of

complex perceptual skills into their primary motor variables. Therefore, from that kind of information, it is necessary, when presented with a reading problem, to look for the perceptual and motor abilities and deficits of the person.

With a test such as the Perceptual-Motor Survey (Roach and Kephart, 1966), it is possible to discover some of those basic deficits and abilities in the broad areas of differentiation, rhythm and balance, for example. These problems can then be dealt with using Kephart's physical exercise techniques.

Once the problem area is defined, it is necessary merely to develop the perceptual-motor area that is affected, using shaping and other behavioural techniques. A chain of necessary motor behaviours is developed to apply to one specific problem. Kephart, too, is very specific in saying that his is not a cook-book approach - each problem is individual and unique and must be dealt with accordingly. This, of course, is also the behaviourist approach.

An analysis of the behaviour of Malawians at work underground showed comparatively large problems in learning a new language and a new job, and a tendency to hurt themselves on the job more than the other ethnic populations. These problems were analysed behaviourally and shown to be indicative of perceptual-motor deficits.

The experimental group was further tested on Day One of the experimental procedure on selected items from the Perceptual-Motor Survey (Roach and Kephart, 1966) to determine the perceptual-motor problems of each individual. Exercises were set up, on the basis of the testing, which were applicable to a group of individuals, each with his own constellation of perceptual-motor difficulties. It was necessary that the treatment should deal with the individual's problem in a group situation. Shaping and chaining the necessary exercises was arranged

so that each subject could benefit from each exercise at his own rate.

Chains of motor behaviours were set up so that all the subjects could benefit from one exercise. Each exercise was presented as a series of behaviours. Those who had problems with one area moved slowly and carefully through the chain, and those having fewer problems in that area moved quickly through the chain and generalised on that ability. Chains of behaviour were also set up regarding the verbal behaviours, so that each subject could learn at his own rate and so that all would be introduced to a maximum number of words in a maximum number of situations. Reinforcement was contingent on an increasing number of behaviours each day.

Generalisation brings up another important area. Kephart and behaviour therapists regard it as imperative that therapy include the generalisation of the newly-learned ability. Without generalisation the behaviour will not be maintained outside the therapeutic situation. It has been shown in many experimental situations that it is response generalisation, or the practice of a behaviour in many different situations, which results in the learning actually taking place (Lovaas, 1961; Paul, 1967 and 1968; and Wolpe, 1948).

The results shown in Figure 9.8 in the results section indicate that the experimental group continued responding verbally at a high level, even when the reinforcement tokens were discontinued. It is the author's view that these results show that the experimental subjects were able to generalise their responses to many situations. It was not only the tokens which were reinforcing by the end of the week. The tokens aided in the initial acquisition of behaviours, but other reinforcers came into play quickly.

The behaviour chains were set up so as to lessen the need for the actual token. A response resulted in a reinforcement which was built into the chain. That is, the response was reinforcing in itself if it was the correct one. And almost always it was the correct one because the chains were set up employing very small increments. That reinforcement then set the stage for the next response, the next link in the chain. And so the behaviour was perpetuated.

The African instructor also came to give social reinforcement, and, in addition, acted as a model for the subjects. They felt they would get better jobs with an increase in their knowledge, which they were getting in the training sessions.

In training, the experimental subjects were taught more words than the control subjects and they were also encouraged to use them in both social and work situations. Thus, when the experimental subjects found they could communicate with other labourers in social situations, this was, no doubt, reinforcing. They were adapting to the new environment. They were then also capable of taking in even more information.

Thus, the response generalisation of the experimental group took place at a faster rate than that of the control group because generalisation was one of the explicit aims of the study, as it always is in behaviour therapy.

10.4 Summary

Actual quantitative results of the study are lacking because of the choice of evaluative devices. However, one can still look at the behavioural analysis and treatment of the problem and evaluate its worth on the basis of the results which point in a positive direction.

It seems that the presenting problem was analysed correctly as a perceptual-motor problem, which is an important point in itself. Very

often such presenting problems are treated on the basis of marginal information, and an underlying perceptual-motor problem is not even noted.

The techniques used in this study were designed to build up a body of perceptual-motor behaviours in the subjects. The necessary physical exercises were broken down into their components and chained so that all the subjects could do them and be reinforced for something, no matter how simple. More complex chains of behaviours were used as the subjects progressed. The behaviours that were learned were generalised upon so that they would be beneficial in the final situation underground.

The verbal behaviours were also treated as chains of behaviour. Words were mimed, and a basic vocabulary was built up through imitation. Then the words were built into longer sentences. Each word was used in as many sentences as possible, so that the subjects would have a useful, generalised vocabulary for underground work.

By use of the chaining procedure, it is possible to treat and teach a group of subjects, because each can go through the chain at his own speed. Physical reinforcement tokens often become redundant when using a chaining technique. The response increment is small, so the resultant change in the environment is easily possible, and to change it becomes inherently reinforcing. The amount of information one gains through chaining depends only on how quickly one makes the first response. After that the reinforcement follows quickly, if the chain is well set up, and that reinforcement becomes the occasion for the consecutive response in the chain.

The test results failed to show conclusively, however, that there was an actual improvement in perceptual-motor functioning in the work situation for the experimental group. On the perceptual test, the CTB, a real baseline was not adequately defined, so the results do not indicate any difference between groups. The results of the checklist

do point in the direction of a positive result for the experimental group. However, the checklist results take account of only 17 per cent of the sample treated. This is not enough material on which to base a definitive conclusion.

It must be noted that of the population sampled by the checklist procedure the majority of the experimental group did not lose time for sickness or injury, and seemed to get on with their work more quickly and with a better understanding of their position in the underground team. In addition, the total time necessary for training subjects was reduced from eighteen days to fourteen days. Altogether, this would save the mining industry a considerable sum, in money and in time.

These are all outcomes of this study which seem to point toward a behaviour modification approach to training adults with perceptual-motor problems. Only further research can clarify the picture beyond this point, but it does seem from the results of this study, sketchy though they may be, that further research will show the importance of behaviour modification in treating perceptually deficient adults.

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CHECKLIST

(as administered by author to shiftbosses in respect of each subject in sample)

There was first a general question regarding what the shiftbosses thought of Malawians, compared with other ethnic groups, in the work situation. (See Appendix B for answers given.)

1. Approximately how long did it take him to understand how to do his job?

- 1) 1 week
- 2) 2 weeks
- 3) 1 month
- 4) 2 months
- 5) 3 months or more

2. How does he perform his job now?

- 1) very well
- 2) fairly well
- 3) average
- 4) below average
- 5) poorly

3. How well does he understand the orders you give him now?

- 1) very well
- 2) fairly well
- 3) average
- 4) below average
- 5) poorly

4. How long was it before he understood your instructions in Panakalo?

- 1) 1 week
- 2) 2 weeks
- 3) 1 month
- 4) 2 months
- 5) 3 months or more

5. Has he been injured during the first three months?

yes
no

6. How often?

- 1) never
- 2) once in 3 months
- 3) twice in 3 months
- 4) three times in 3 months
- 5) four times in 3 months

7. How long was he off for each injury?

- 1) never
- 2) 1 day
- 3) 2 days
- 4) 3 days
- 5) 4 days or more

8. Has he caused an accident which injured others?
yes
no
9. Has he been ill during the first three months?
yes
no
10. How often was he ill during that period?
1) never
2) once
3) twice
4) three times
5) four or more times
11. How long was he off for each illness?
1) never
2) 1 day
3) 2 days
4) 3 days
5) 4 days or more
12. Was he absent for any other reason?
yes
no
13. If so, what for?
14. How long was he away for each period?
1) never
2) 1 day
3) 2 days
4) 3 days
5) 4 days or more
15. Do they take note of the safety signs and obey them?
yes
no
16. If not, what kinds of unsafe behaviours do they engage in?

Notes: (1) Each of the shiftbosses had two or three subjects in his section, on whom he was required to report. None of the shiftbosses was aware of the fact that some were control subjects and some experimental subjects.

(2) Scoring - with 1 point for the first answer to 5 for the last answer to each question - is set out in Appendix C.

APPENDIX BWHAT SHIFTBOSES THINK OF MALAWIANS
(as compared with other ethnic groups)GROUP I - (SHIFTBOSES WHO HAD SUBJECTS FROM CONTROL GROUP)

- Shiftboss 1 : Difficult to get used to, take a long time to learn, but fair workers.
- 2 : No difference, none has enough schooling to do very well.
- 3 : Take a long time to learn, but they do a fair job.
- 4 : Good workers, like supervision, loyal and reliable.
- 5 : Half same as others, half better.
- 6 : Good, retain what they learn and seek to better themselves.

GROUP II - (SHIFTBOSES WHO HAD SUBJECTS FROM EXPERIMENTAL GROUP)

- Shiftboss 1 : Good workers, more intelligent.
- 2 : The intelligent ones (winch drivers, for example) are better than average, the rest same as others.
- 3 : Fair, but not up to same standard after training.
- 4 : Once used to the job, they do fair work.
- 5 : Good workers, they have a long contract and we can get better acquainted, therefore they do a better job.
- 6 : No difference, fair workers.

REPLIES TO QUESTIONS

[illegible]

APPENDIX D

PAGE 1 OF 8

C O N T R O L G R O U P

NO	1	2	3	4	5	6	7	8	9	10
1	5	22	7	21	15	6	6	24	26	6
2	4	27	5	28	25	16	4	38	28	20
3	3	21	5	29	24	12	4	39	26	24
4	2	21	5	31	24	12	5	30	24	24
5	0	22	11	4	6	6	10	8	10	4
6	0	21	7	16	12	14	5	32	25	10
7	0	19	8	9	15	8	5	24	19	28
8	5	20	7	30	16	2	5	35	25	6
9	5	22	5	34	22	10	5	36	17	22
10	6	23	3	34	23	34	3	37	24	34
11	2	22	9	16	10	2	8	17	10	8
12	0	20	9	11	10	4	8	14	19	4
13	3	19	7	20	25	4	5	32	29	6
14	0	19	5	29	22	18	4	34	24	24
15	3	32	6	29	19	10	5	37	31	8
16	6	18	7	25	20	2	4	37	28	22
17	0	19	7	24	16	6	5	36	23	14
18	4	30	4	39	26	24	2	39	28	36
19	4	22	6	35	26	2	2	38	29	36
20	0	20	5	37	26	12	3	39	28	30
21	8	22	5	32	30	4	4	35	30	24
22	7	21	5	33	27	14	3	36	26	32
23	0	35	8	10	10	6	6	31	17	8
24	0	22	10	10	3	4	10	14	5	2
25	0	22	10	10	4	6	8	17	12	6
26	6	19	4	36	25	18	2	39	32	30
27	0	31	7	22	23	4	5	37	28	10
28	8	22	3	39	24	30	3	39	25	34
29	0	36	8	25	6	0	8	21	8	2
30	0	35	7	24	12	4	6	28	18	6
31	0	24	7	18	17	8	7	25	20	4
32	0	24	5	28	24	20	3	36	29	34
33	0	38	6	27	20	8	6	30	24	6
34	0	26	9	9	14	6	7	27	15	6
35	0	22	8	17	12	4	7	23	20	6
36	0	20	6	24	26	6	5	38	28	10
37	5	35	4	36	24	22	5	27	24	24
38	6	31	6	32	18	2	6	24	28	4
39	0	21	5	21	20	24	4	35	28	26
40	5	18	5	27	23	24	3	36	29	28
41	8	29	5	34	23	20	4	38	26	24
42	0	36	7	23	12	10	6	33	21	10
43	0	18	7	16	16	12	4	36	26	22
44	5	20	7	18	15	18	4	32	25	32
45	5	35	5	33	26	18	4	36	29	18
46	3	38	5	25	22	20	3	33	30	32
47	0	22	8	21	10	4	8	16	17	6
48	0	45	9	12	9	6	7	16	19	6
49	0	18	8	16	13	6	7	22	23	6
50	0	18	7	20	18	4	5	37	29	6

C O N T R O L G R O U P

NO	1	2	3	4	5	6	7	8	9	10
51	0	24	8	14	19	2	8	14	19	6
52	5	23	5	34	28	6	3	35	31	28
53	0	26	7	23	19	6	5	33	26	8
54	5	22	2	39	28	34	3	39	28	32
55	3	19	6	25	17	12	7	17	22	8
56	0	28	7	27	18	6	5	38	28	6
57	5	19	4	28	26	28	3	32	31	34
58	2	18	7	11	19	10	6	32	26	6
59	2	19	6	21	24	8	6	22	25	8
60	0	41	7	17	17	12	6	28	20	8
61	0	19	6	27	21	10	5	36	27	4
62	8	25	2	39	28	36	1	39	32	36
63	2	26	8	24	6	2	5	36	28	8
64	2	34	6	22	17	16	5	28	21	24
65	0	19	2	34	32	36	2	39	32	32
66	0	18	8	16	12	4	8	12	18	4
67	0	26	8	21	10	4	8	17	14	6
68	3	21	6	26	21	6	5	37	25	8
69	5	24	6	28	16	14	4	37	22	30
70	0	19	7	17	18	8	9	9	10	6
71	0	24	9	13	10	0	9	14	11	4
72	0	18	9	10	12	6	9	15	6	6
73	3	22	7	17	16	8	6	28	15	14
74	0	19	7	20	18	10	7	26	10	12
75	5	19	7	20	19	6	5	36	26	6
76	4	20	6	23	26	8	5	35	27	14
77	0	19	4	30	25	28	2	35	30	36
78	0	39	9	18	6	0	9	18	7	0
79	3	22	5	26	27	14	4	37	26	22
80	0	21	5	35	24	8	3	39	30	28
81	0	31	9	12	11	4	6	25	20	14
82	0	24	7	16	21	6	5	33	27	14
83	0	21	8	12	15	4	7	21	10	12
84	0	32	9	15	6	2	8	14	15	4
85	4	24	7	14	20	6	5	37	21	8
86	0	22	6	18	14	26	4	31	22	30
87	5	22	8	11	12	8	8	9	17	6
88	2	24	6	22	25	14	3	33	30	32
89	6	26	2	37	31	32	2	39	30	36
90	0	22	4	35	22	26	3	37	28	28
91	0	20	6	28	24	8	4	37	32	16
92	4	21	3	35	30	26	3	39	30	28
93	0	19	9	14	7	6	6	32	20	6
94	5	19	5	27	23	22	4	37	22	30
95	0	23	6	26	22	12	6	33	21	10
96	0	20	7	15	19	6	6	29	27	6
97	6	21	7	21	22	2	6	22	22	8
98	0	20	8	18	13	2	7	23	21	4
99	0	21	6	19	20	24	5	23	22	28
100	0	26	9	11	14	4	9	15	12	2

C O N T R O L G R O U P

VARIABLE	MEAN	STAND.DEVIAT.	VARIANCE
1	2.07	2.54	6.45
2	23.93	6.04	36.43
3	6.42	1.88	3.52
4	23.10	8.59	73.73
5	18.67	6.70	44.93
6	11.24	9.13	83.29
7	5.28	2.02	4.08
8	29.55	8.83	78.05
9	22.86	6.72	45.19
10	15.96	11.37	129.37

CONTROL GROUP										
CORRELATION COEFFICIENTS										
NO	i	2	3	4	5	6	7	8	9	10
1	1.00									
2	-0.07	1.00								
3	-0.54	0.10	1.00							
4	0.57	0.01	-0.87	1.00						
5	0.50	-0.19	-0.86	0.73	1.00					
6	0.36	-0.08	-0.82	0.57	0.57	1.00				
7	-0.49	0.12	0.85	-0.77	-0.80	-0.68	1.00			
8	0.39	-0.09	-0.72	0.70	0.71	0.48	-0.88	1.00		
9	0.41	-0.13	-0.71	0.65	0.75	0.46	-0.85	0.78	1.00	
10	0.47	-0.15	-0.78	0.66	0.67	0.79	-0.85	0.61	0.56	1.00

E X P E R I M E N T A L G R O U P

NO	1	2	3	4	5	6	7	8	9	10
1	2	27	6	34	26	0	4	38	26	16
2	4	20	5	39	22	16	3	37	32	30
3	0	25	6	21	26	6	5	31	29	14
4	4	20	5	27	18	20	4	33	26	30
5	0	21	7	21	15	10	6	34	25	4
6	5	20	3	38	25	28	2	39	32	32
7	0	25	8	21	14	2	6	25	21	12
8	8	24	2	39	28	36	2	39	30	36
9	3	20	5	30	29	12	3	37	32	30
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17	0	22	9	12	13	0	6	31	22	6
18	0	19	9	12	7	6	7	29	14	6
19	0	20	12	6	5	2	8	14	11	12
20	5	21	4	39	25	26	2	39	28	36
21	4	20	3	38	32	24	2	39	32	30
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23	5	25	6	23	24	14	4	39	25	26
24	0	22	7	24	17	6	7	19	25	2
25	5	22	7	19	20	12	6	32	12	14
26	0	18	9	14	13	0	8	20	9	4
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29	5	24	3	38	26	26	2	39	32	30
30	0	21	8	16	14	2	8	8	20	4
31	0	22	6	24	12	18	6	24	13	18
32	6	23	4	31	28	28	4	34	29	26
33	5	20	4	32	29	24	1	39	32	36
34	0	18	9	17	8	2	9	15	10	2
35	6	30	6	35	22	6	6	34	22	4
36	0	20	7	27	14	4	6	29	24	2
37	0	39	10	10	5	6	10	12	4	4
38	5	22	8	21	11	4	7	21	25	4
39	6	21	4	37	25	26	3	39	24	28
40	5	20	6	35	24	4	4	39	29	20
41	6	30	6	22	21	10	6	29	29	6
42	5	19	3	35	30	28	2	39	29	32
43	5	20	5	32	22	14	4	33	24	30
44	5	19	6	35	21	6	5	39	27	8
45	0	21	6	34	17	4	6	36	15	2
46	0	23	5	39	22	12	5	36	23	18
47	5	24	3	31	28	36	2	39	28	34
48	6	36	4	29	28	26	2	31	32	34
49	6	23	5	34	29	14	4	31	30	24
50	4	25	7	20	19	2	7	28	20	2

EXPERIMENTAL GROUP

NO	1	2	3	4	5	6	7	8	9	10
51	0	23	9	7	15	4	7	24	21	2
52	0	24	9	13	3	10	8	14	9	8
53	5	19	8	13	22	4	6	29	27	6
54	0	20	9	17	6	0	8	13	14	6
55	0	28	8	15	10	6	7	23	15	2
56	0	29	8	23	8	6	7	23	13	4
57	6	23	6	25	23	4	5	36	28	4
58	5	21	6	15	18	22	5	21	24	30
59	0	20	7	18	16	6	5	31	27	12
60	4	22	5	26	23	26	3	39	32	26
61	5	26	3	31	28	32	3	30	27	31
62	5	22	5	22	21	34	3	37	25	32
63	0	22	8	15	16	4	7	16	28	4
64	0	26	8	14	17	2	8	22	11	6
65	6	20	1	39	32	36	1	39	32	36
66	3	24	7	13	20	10	7	19	14	12
67	5	21	4	33	21	28	2	37	30	36
68	0	27	7	20	10	12	6	21	19	14
69	0	38	10	11	6	2	7	21	15	7
70	0	23	6	30	21	4	5	28	27	14
71	3	23	6	19	21	12	5	25	21	24
72	0	22	8	20	10	4	8	15	7	10
73	0	23	5	32	25	20	4	35	25	22
74	0	20	7	20	10	16	4	37	28	24
75	0	24	7	15	14	14	4	32	26	24
76	0	22	9	17	9	4	7	21	17	6
77	7	18	6	24	24	6	4	39	30	16
78	3	22	6	23	21	14	3	38	32	24
79	0	24	9	15	4	6	8	13	15	4
80	0	23	5	27	26	20	4	34	26	22
81	0	18	9	15	10	2	8	18	6	8
82	6	20	4	35	29	18	4	39	32	12
83	3	32	9	17	7	0	7	22	16	4
84	0	24	7	24	15	4	6	26	25	0
85	5	20	4	37	24	20	3	38	20	34
86	6	21	4	30	25	32	4	28	25	26
87	6	22	5	37	24	16	3	39	28	32
88	0	24	7	15	15	10	4	27	24	26
89	6	24	8	14	16	2	6	30	22	4
90	0	28	10	10	0	10	9	7	7	10
91	0	26	5	31	25	14	3	34	26	32
92	5	19	6	36	15	6	5	37	24	^
93	5	23	6	32	23	4	5	33	27	12
94	0	24	6	27	24	6	5	28	29	12
95	0	29	8	14	11	6	6	30	24	6
96	0	23	7	19	11	8	7	18	18	4
97	3	27	5	32	22	20	4	37	32	14
98	0	26	6	20	30	8	5	35	27	8
99	0	20	8	17	19	0	6	26	22	4
100	8	26	7	27	23	0	4	39	30	16

E X P E R I M E N T A L G R O U P

VARIABLE	MEAN	STAND.DEVIAT.	VARIANCE
1	2.51	2.67	7.12
2	23.02	4.00	16.00
3	6.35	2.05	4.21
4	24.26	9.04	81.81
5	18.99	7.64	58.39
6	11.78	10.10	102.05
7	5.15	2.01	4.05
8	29.20	8.76	76.69
9	23.23	7.17	51.45
10	15.86	11.30	127.68

EXPERIMENTAL GROUP
CORRELATION COEFFICIENTS

NO	1	2	3	4	5	6	7	8	9	10
1	1.00									
2	-0.10	1.00								
3	-0.57	0.20	1.00							
4	0.53	-0.22	-0.86	1.00						
5	0.56	-0.19	-0.85	0.71	1.00					
6	0.46	-0.11	-0.83	0.59	0.56	1.00				
7	-0.58	0.19	0.89	-0.77	-0.80	-0.77	1.00			
8	0.59	-0.20	-0.77	0.76	0.75	0.54	-0.87	1.00		
9	0.53	-0.18	-0.72	0.63	0.77	0.47	-0.81	0.75	1.00	
10	0.48	-0.17	-0.78	0.61	0.62	0.84	-0.87	0.61	0.54	1.00

Author Rendu K

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