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A STUDY OF THE RELATIONSHIPS BETWEEN PERCEPTION, PERSONALITY, INTELLIGENCE AND GRADE ONE READING ACHIEVEMENT.

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TO UNCOVER BASIC PERCEPTUAL AND PERSONALITY DIFFERENCES POSSIBLY RESPONSIBLE FOR DIFFERENCES IN READING ACHIEVEMENT, TWO STRATIFIED SAMPLES OF 60 ABOVE- AND BELOW-AVERAGE READERS WERE SELECTED FROM THE ENTIRE POPULATION OF 5,612 CHILDREN COMPLETING FIRST GRADE IN EDMONTON, ALBERTA, CANADA. THE GROUPS WERE MATCHED ACCORDING TO SEX, SCHOOL, GROUP INTELLIGENCE SCORES, AND, IN 25 OF THE 30 PAIRS, TO THE FIRST-GRADE TEACHER. SEVEN MEASURING INSTRUMENTS WERE USED--THE EDMONTON PUBLIC SCHOOL WORD RECOGNITION TEST, THE GATES PRIMARY READING TESTS, THE MARIANNE FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION, THE WEPMAN AUDITORY DISCRIMINATION TEST, THE PEABODY PICTURE VOCABULARY TEST, THE STANFORD-BINET TEST, AND A FIVE-POINT RATING SCALE ADAPTED BY THE INVESTIGATOR AFTER MALMQUIST TO MEASURE CONCENTRATION, PERSISTENCE, AND DOMINANCE/SUBMISSIVENESS. THE MAIN ANALYSIS USED WAS THE MULTIPLE LINEAR REGRESSION DEVELOPED BY BOTTENBERG AND YOUNG. SIGNIFICANT RELATIONSHIPS WERE FOUND BETWEEN SEVERAL FACTORS--PERCEPTUAL, INTELLECTUAL AND PERSONALITY--AND EARLY READING ACHIEVEMENT. A BATTERY CONSISTING OF THE FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION, THE WEPMAN AUDITORY DISCRIMINATION TEST, AND A TEACHER'S RATING FOR PERSONALITY TRAITS, PARTICULARLY CONCENTRATION, APPARENTLY HELPED DIAGNOSE PERCEPTUAL AND PERSONALITY WEAKNESSES WHICH MIGHT UNDERLIE PRIMARY READING DEFICIENCIES. THIS PAPER WAS PRESENTED AT THE INTERNATIONAL READING ASSOCIATION CONFERENCE (SEATTLE, MAY 4-6, 1967). (RH)

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# A STUDY OF THE RELATIONSHIPS BETWEEN PERCEPTION, PERSONALITY INTELLIGENCE AND GRADE ONE READING ACHIEVEMENT

by

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Session XII - Psychology of Reading
Specific Studies
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## THE PROBLEM

It is generally acknowledged that numerous factors are involved in the achievement of reading skills at the grade one level. One of the most important of these factors appears to be the level of maturation of certain perceptual abilities. Vernon (1960) and others have attempted to determine the developmental sequence of these abilities, and efforts

have been made by Wepman (1958) and Frostig (1963) to assess these abilities by means of standardized tests.

Gross deficiencies in perceptual skills have long been used as criteria for setting up special methods of instruction, for example, hard of hearing, sight-saving and cerebral-palsied classes. Minor deficiencies in perceptual skills are not usually detected by instruments at present in normal use in the classrooms of public schools. Furthermore, primary teachers do not usually have the training to ascertain the nature of reading disability at the grade one level.

Few investigations apart from Malmquist's extensive study in Sweden (1958) have been concerned with the effect of personality factors on primary reading achievement. Measures to assess personality traits are difficult to formulate, and not in general use in schools.

Much research in reading has been concerned with the relationship of one or two factors with reading achievement, often with a population of retarded readers.

This study attempted to investigate the inter-relationships of visual and auditory perception, intelligence and personality factors, with primary reading achievement.

In order to uncover basic perceptual and personality differences which my be responsible for differences in reading achievement, the investigator worked with two stratified samples of above-and below-average readers, who were selected from the entire population of children completing their grade one year in the City of Edmonton, Alberta, Canada in June, 1965. Deliberately excluded from the sample

were children whose retardation in reading might be due to factors other than perceptual and personality, for example, physical or educational factors. Perceptual tests were chosen both for their diagnostic possibilities, and for their ease in administration by classroom teachers. An aural vocabulary test was chosen that could easily and speedily be administered and scored by classroom teachers. Teachers were instructed in the use of a five-point rating scale in order that they might assess three personality traits, concentration, dominance/submissiveness and persistence.

## The Population

In order to uncover basic perceptual and personality differences which may be responsible for differences in reading achievement, the investigator worked with two stratified samples of above-and below-average readers, who were selected from the entire population of 5, 612 children completing their grade one year in the City of Edmonton, Alberta, Canada in June 1965.

Deliberately excluded from the sample were

a) children not in the average range of intelligence on group intelligence tests.

b) children with below-average achievement in arithmetic.

c) children showing major emotional disturbance.

d) children whose home background was likely to affect their reading achievement.

e) those having gross physical disabilities (for example, defective vision, auditory inacuity or speech defects) recorded on school medical cards.

Individual telebinocular and audiometric screening was carried out as a further check against visual and auditory defects.

The two groups were then matched according to sex, and to school, and as near as possible to group intelligence scores, and in twenty-five out of the thirty pairs to the grade one teacher. The final sample came from six schools with a gradation of socioeconomic status from lower to upper middle class established by two independent checks.

The Measuring Instruments

Following the selection of the sixty subjects, the following tests were used to determine levels of reading achievement, visual perception, auditory discrimination, aural vocabulary and intelligence.

1. The Edmonton Public School Word Recognition Test (Revised 1961) and
2. The Gates Primary Reading Test (Type PPR), both group tests of silent reading administered by classroom teachers as part of the regular testing program at the end of the children's first year in school, in June, 1965.

Below-average readers had a combined score of between 32 and 50 (a B or C but not D rating according to local norms). Above-average readers had a combined score of between 90 and 113, an A but not H rating according to local norms.

3. The Marianne Frostig Developmental Test of Visual Perception, a group test measures five aspects of visual perception, namely the abilities to
   a. co-ordinate hand and eye.
   b. discriminate between figure and ground.
   c. perceive constancy of shape.

d. perceive position in space.

e. analyse spatial relationships.

4. The Wepman Auditory Discrimination Test (Fm I), an individual test, measures the ability to make fine discrimination in common English phonemes.

5. The Peabody Picture Vocabulary Test (Form B), is an individual test of aural vocabulary which measures the level of understanding the spoken word.

6. The Stanford-Binet Test (Form L-M), an individual intelligence test, was carried out by graduate students of The Division of Educational Psychology, University of Alberta. The other measures were administered by the investigator.

7. A five point rating scale was adapted by the investigator after Malmquist (1958) to measure three personality variables, namely concentration, dominance/submissiveness and persistence. The Personality Rating Scale was completed by classroom teachers in November 1965.

The data were analysed to fit the two purposes of the study namely

1) to investigate the inter-relationships of visual and auditory perception, intelligence and personality traits with reading achievement at the end of grade one and

2) to find a combination of testing instruments that could be used by grade one teachers for early diagnosis and remediation of reading deficiency.

The main analysis used was that of multiple linear regression developed by Bottenberg and Young (1963) which not only gave means, standard deviations and multiple correlations, but also determined the contribution of single, pairs or triads of predictors to reading achieve-

TABLE I

CORRELATIONS OF READING ACHIEVEMENT SCORES WITH SCORES ON FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION, WEPMAN TEST OF AUDITORY DISCRIMINATION, PEABODY PICTURE VOCABULARY TEST, STANFORD-BINET INTELLIGENCE SCALE, PERSONALITY RATINGS AND SEX

| N = 60 | Marianne Frostig Developmental Test of Visual Perception | | | | | | | | Personality Ratings Derived from Malmquist | | | | Sex |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sub-Test I | Sub-Test II | Sub-Test III | Sub-Test IV | Sub-Test V | Composite Score | Wepman Test of Auditory Discrimination, Form I | Stanford-Binet Form L-M Intelligence Quotient | Concentration | Dominance/ Submissiveness | Persistence | Peabody Picture Vocabulary Test, Form B | Male |
| Reading Achievement (composite score of Edmonton Public School Board Word Recognition Test and Gates Primary Paragraph Reading Test (PPR) | .361 | .241 | .445 | .206 | .313 | .615 | -.571 | .536 | -.696 | -.557 | -.557 | .157 | -.051 |
| Significance Level | .01 | NS | .01 | NS | .05 | .01 | .01 | .01 | .01 | .01 | .01 | NS | NS |

Correlations r .33 exceed the 1% level of confidence
r .26 exceed the 5% level of confidence

ment, in the presence of the other independent variables. The differences between variances was tested by an F-ratio test, while the difference between means was tested by the T-test both for independent samples.

## Results

1. Correlations between reading achievement and the other variables are shown in Table I. All are significant at the one per cent level of confidence with the exception of three of the D.T.V.P. sub-tests, aural intelligence, and sex of the subject.

Examination of the means and standard deviations for the total group and a comparison of means between good and poor readers provide further evidence that by the beginning of the grade two year the abilities to perceive position in space as measured by D.T.V.P. sub-test IV, and the abilities to distinguish figure from ground (D.T.V.P. sub-test II), and to analyse spatial relationships (D.T.V.P. sub-test V), had matured sufficiently in many of the sixty subjects so that those particular aspects of visual perception were no longer an important factor influencing their reading achievement.

The means of the scores on the P.P.V.T. show no significant difference between below-and above-average readers. Apparently there was no great difference between the aural vocabulary of good and poor readers in this study at the primary level.

The lowest correlation of all variables with reading is that of sex. This result may be put down to the design of this experiment, which required an equal number of male and female below-average readers in a specific attempt to rule out the influence of sex on reading achievement

TABLE II

REGRESSION ANALYSIS USING FIVE SELECTED VARIABLES AND RESTRICTING SINGLE PREDICTORS IN TURN

| Row | Predictor | Criterion | RSQ full | RSQ restricted | F Ratio | Degrees of Freedom | Probability |
|---|---|---|---|---|---|---|---|
| 14. | Frostig Visual Composite Score, in presence of Wepman Auditory Discrimination, Stanford-Binet Intelligence scores and concentration rating. | composite reading score | .679 | .626 | 9.171 | 1/56 | <.01 |
| 15. | Wepman Auditory Discrimination Score, in presence of visual composite and intelligence scores, and concentration rating. | composite reading score | .679 | .632 | 8.037 | 1/56 | <.01 |
| 16. | Stanford-Binet Intelligence Score in presence of visual and auditory scores and concentration rating. | composite reading score | .679 | .654 | 4.351 | 1/56 | <.05 |
| 17. | Concentration rating, in presence of visual auditory and intelligence scores. | composite | .679 | .599 | 13.822 | 1/56 | <.01 |

TABLE IV

REGRESSION ANALYSIS RESTRICTING COMBINATIONS OF THREE VARIABLES IN TURN FROM THE FOUR SELECTED PREDICTORS OF PRIMARY READING

| Row | Predictors | Criterion | RSQ full | RSQ restricted | Difference | F Ratio | Degree of Freedom | Probability |
|---|---|---|---|---|---|---|---|---|
| 23. | Frostig Visual Composite, Wepman Auditory and Stanford-Binet Intelligence scores, in presence of concentration. | composite reading score | .679 | .484 | .194 | 11.282 | 3/56 | <.01 |
| 24. | Frostig Visual Composite, Wepman Auditory Scores and Concentration Rating, in presence of intelligence. | composite reading score | .679 | .321 | .358 | 20.759 | 3/56 | <.01 |
| 25. | Wepman Auditory, Stanford-Binet Intelligence Scores and Concentration Rating, in presence of visual perception. | composite reading score | .679 | .408 | .270 | 15.700 | 3/56 | <.01 |

from the present investigation.

The personality rating for concentration provides the best correlation -.696. It should be noted that although the personality ratings and the auditory discrimination score produce correlation coefficients with minus values, (except with each other), that the relationship is positive since a high score indicates a poor performance.

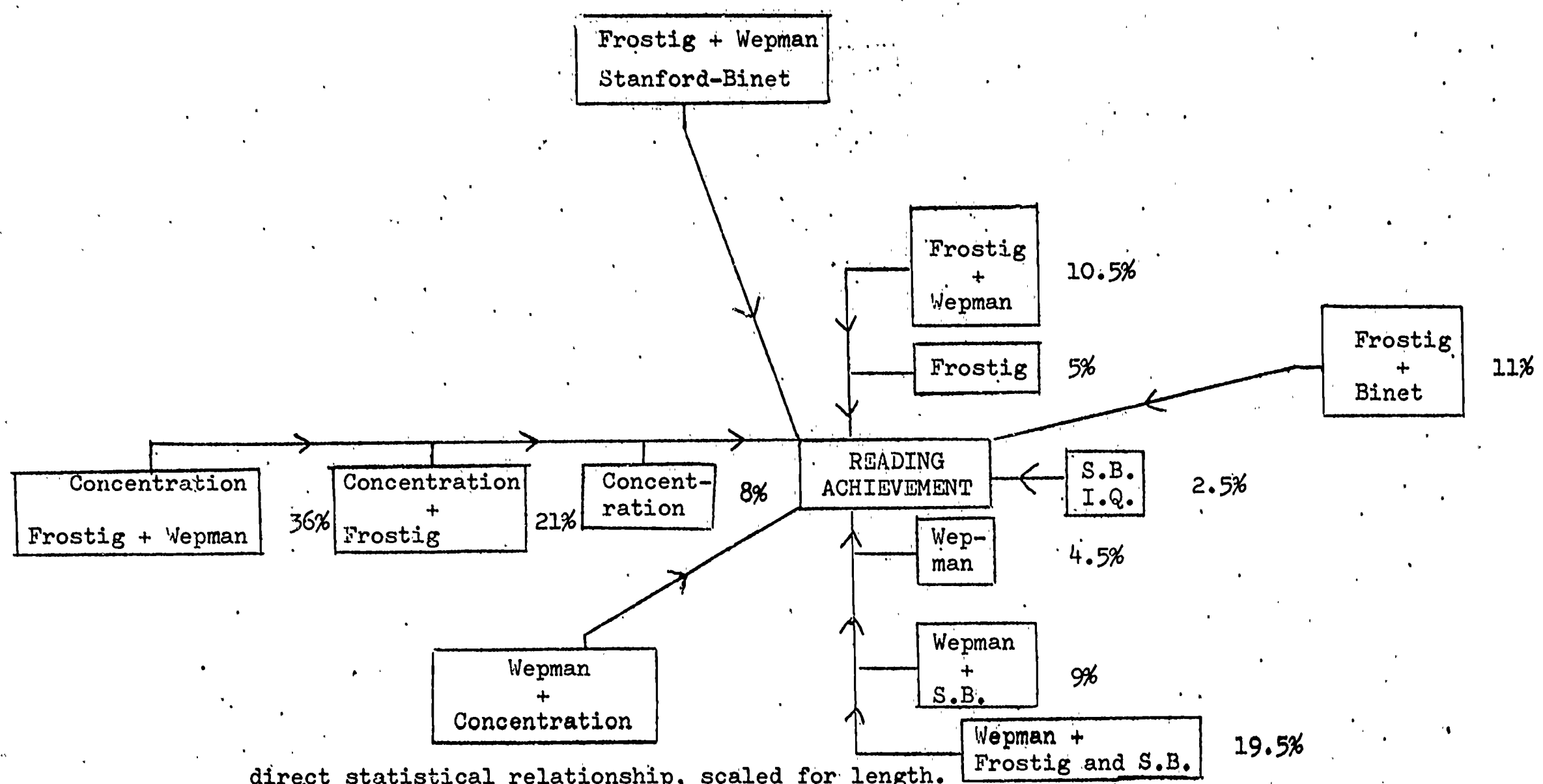
2. Multiple linear regression equations were now constructed in order to predict the contribution to reading achievement of independent variables, singly, in pairs or in triads. The original regression analysis employing all fifteen variables, disclosed only two variables, concentration and auditory discrimination, to have significant high F-ratios at the five per cent level of probability.

In order to reduce redundancy and increase effectiveness of prediction, reading achievement was now held to be a function of visual perception, as measured by the composite D.T.V.P. score, auditory discrimination as measured by the W.A.D.T. intelligence as measured by the S.B. score, and concentration as measured by a five point teachers' rating.

Table II shows that the best single predictor for primary reading achievement is the five-point personality rating for concentration.

Table III discloses that the pair of variables most strongly predicting reading is a combination of visual perception, as measured by the composite D.T.V.P. score, and the concentration-rating.

Table IV shows the most effective triad of predictors of reading achievement to be a combination of visual and auditory perception with concentration. This is a [illegible] superior combination to one of visual and auditory perception with intelligence. All possible triads secure sufficiently high F-ratios to rate probabilities beyond the one per cent




——— direct statistical relationship, scaled for length. (arrow indicates assumed direction)

--------- postulated influence of one predictor variable on another.

FIGURE 2

LOGICAL AND STATISTICAL RELATIONSHIP OF VARIABLES TO READING ACHIEVEMENT

level of confidence.

The results of the regression analysis confirmed and extended the conclusions drawn by comparing means and examining correlation coefficients.

Figure 2 which illustrates the logical and statistical relationships of the four predictor variables shows the percentage contribution to the variance in reading achievement made by the variables singly, in pairs, and then in triads. For example the variable concentration alone contributed eight per cent of the variance in reading achievement.

By adding the composite D.T.V.P. score to the concentration rating, the predictive value rose to twenty-one per cent, and the further inclusion of the W.A.D.T. scores to thirty-six per cent. These three produced the best combination, and thirty-six per cent was the highest percentage of the total variance in reading achievement that could be predicted from the independent variables finally used in this study.

To what then, could the remaining sixty-four per cent of variance be attributed? First it should be noted that intelligence was excluded from the predictor battery discussed in the previous paragraph. The inclusion of this variable would no doubt considerably reduce the proportion of unattributed variance. Inter-correlations between the chosen variables contributed some of the remaining sixty-four per cent of variance. It was noticed that the simultaneous restriction of three variables produced a greater increase in predictive power than the sum of the contributions of the three variables taken separately. Apparently, by combining the effects of two or three predictors, the effect of intercorrelation was reduced, and the predictive value increased. It would not be unreasonable to postulate, for example, that an ability to concentrate would enhance performance on tests of visual and auditory perception, or that

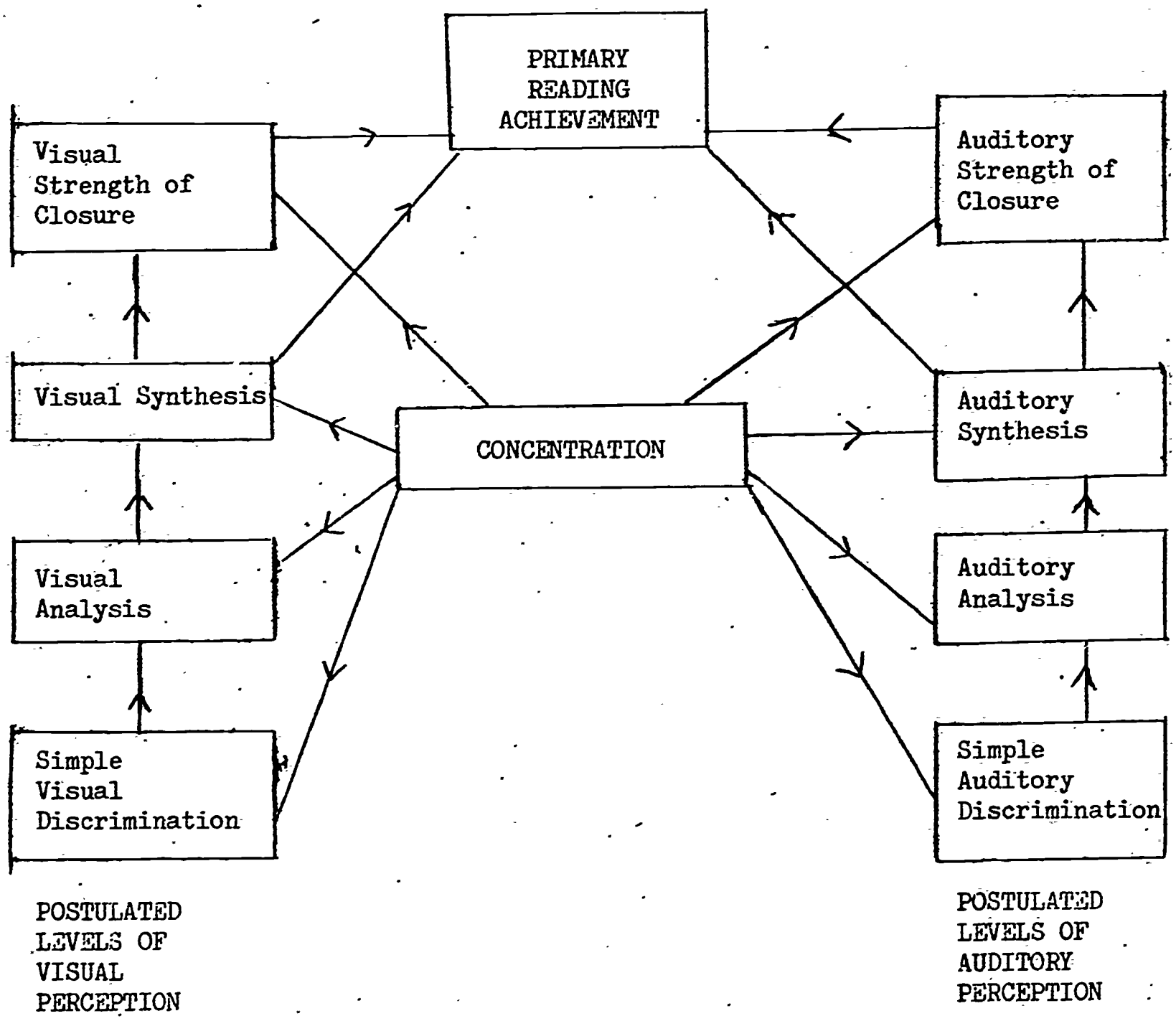



FIGURE I

POSTULATED RELATIONSHIPS BETWEEN CONCENTRATION AND PERCEPTION

high ability in perception and concentration would correlate well with performance on intelligence tests. Nevertheless a considerable proportion of the variance was not accounted for.

Some of the factors that might contribute to the unaccounted proportion of variance could be socio-economic status, the cultural level of the home, the affection displayed by the parents, the child's position in the family, and his emotional stability. Few of these can be easily assessed by the school, and perhaps their evaluation should be left to clinicians dealing with severe cases of reading disability.

## Conclusions

1. Above-average readers differ from below-average readers in many respects, in levels of certain aspects of visual perception, in levels of auditory discrimination and intelligence, in measures of three personality traits, but not in aural vocabulary. The findings of the present study are compatible with those of Malmquist (7), who reported that at the end of the first year in school, differences in many factors are already evident in good, medium and poor readers.
2. When, however, children are in the average range of intelligence and possess no speech defect, their level of aural vocabulary is not a significant factor governing their ability to learn to read. This conclusion is in agreement with that of Harrington (9), who suggested that most children come to school with a sufficiently adequate aural vocabulary to begin reading.
3. Examination of the means and standard deviations of each D.T.V.P. sub-test point to the conclusion previously advanced by Gates and

Malmquist (7), that visual perception is not a unitary ability, but rather composed of different aspects or specialized areas. Vernon (15), has suggested that development in different areas may proceed at different paces, and vary according to the difficulty of material perceived. Evidence from the means and standard deviations confirm Vernon's opinion. By the end of grade one, a successful reader has attained not only a fairly complex level of discrimination, but can hold a figure against distraction.

4. Intelligence appears to enjoy a significant relationship, though less than those of visual and auditory perception and personality traits with primary reading achievement. A general trend apparent in the research, into which the present investigation seems to fit, is that at the end of grade one, a child's intelligence may be a significant factor governing how he reads, but there are many other factors which may have greater significance.

5. Good readers differ from poor readers in personality traits. While certain personality traits, in particular concentration, have highly significant relationships not only with reading achievement but also with visual and auditory perception and intelligence. It might be speculated that like visual perception, auditory perception may have levels of analysis and synthesis, and particularly require 'strength of closure', where the memory of a sound must be held against distraction, for as Vernon (15) has suggested, it is vital to attend, for "auditory stimuli, once lost, are gone forever." (p. 61)

Caution must be exercised, however, when considering the value of the personality factors, as they were measured by teacher's ratings which are of necessity subjective, liable to be influenced by halo effects, sex bias or prejudice. Furthermore, there appears to be no satisfactory way

to test reliability or validity of this measure.

6. Finally, multiple regression analysis demonstrated that a battery of tests rather than one single measure best predicts primary reading achievement. In this investigation, a combination of The Marianne Frostig Developmental Test of Visual Perception, the Wepman Auditory Discrimination Test, and a teacher's rating for a personality trait, concentration, provided the best prediction for the end of grade one reading score. Many researchers have mentioned the importance of visual and auditory perception in primary reading. The evidence from the present study shows that if a measure of concentration rather than a measure of individual intelligence is combined with visual and auditory perceptual scores, a better prediction of reading is achieved.

## LIMITATIONS OF THE FINDINGS OF THE STUDY

1. The population from which the sample for this study was selected consisted of the grade one students registered in the public schools of the City of Edmonton, Alberta, Canada, for the year 1964-65. The sample was not randomly selected from the available population. Because an attempt was being made to study some of the factors affecting reading achievement, restrictions were placed on the selection of the sample with the aim of reducing the effect of other variables. Pupils selected were matched in respect to sex, school, freedom from gross physical and emotional handicaps, as near as possible to group intelligence scores and in twenty-five out of thirty pairs to the same grade one teacher.

2. The selected sample was stratified with respect to reading achievement. Consideration of the means and standard deviations of all other variables indicate that these were normally distributed
3. A preliminary attempt was made to reduce the correlation of intelligence with reading achievement by restricting the population to the normal range of intelligence, ninety to one hundred and twenty I.Q. points as measured on the Detroit Beginners Intelligence Test. Subsequent individual Stanford Binet ratings considerably extended the range of intelligence scores.
4. The discriminatory power of The Marianne Frostig Developmental Test of Visual Perception, particularly with respect to sub-tests II, IV and V, appears to diminish with increasing age. Its peak of effectiveness is probably reached at the beginning of the grade one year.

## IMPLICATIONS

1. Preliminary eye and ear screening revealed that approximately one in every eleven potential subjects had a hearing deficiency, while one in every nine had a visual defect, all previously undetected. Improved visual screening together with an individual audiometric check at the grade one level might lead to fewer learning casualties.
2. Two aspects of visual perception appear very important to success in end of grade one reading. The findings in this study support the thesis advanced before, that by the end of grade one most children's powers of visual perception are becoming increasingly more mature. It was suggested that visual perception might be considered as a series of hierarchical levels beginning with simple visual discrimination, continuing through visual analysis and synthesis, and finally arriving

at retention through strength of visual closure. In this study good readers emerge as significantly superior to poor readers, only at the more complex levels. Therefore exercises to encourage visual memory, to hold in mind letters and words against distraction, might be more beneficial than the simple matching exercises commonly found in primary workbooks.

3. The second aspect of visual perception which appears to have matured in good readers but not in poor ones is that of eye-motor co-ordination, demonstrated in D.T.V.P. sub-test I. Perhaps poor eye-motor co-ordination is a symptom of a general immaturity of fine neurological integrations, one form of which must be used for reading. It might also be conjectured, as de Hirsch (2) did, that maturity comes through increasingly finer and more complex integration of neural systems. It might then be implied that muscular co-ordination be viewed as a continuum extending from gross to increasingly finer co-ordination, and that additional measures to test gross co-ordination be used if eye-hand co-ordination is shown to be defective by D.T.V.P. sub-test I, so that specific remediation may take place at the level of need.

4. It has been shown that the Wepman Auditory Discrimination Test differentiates between good and poor readers at the end of grade one. This finding supports Wepman's theory that auditory perception has not a unitary aspect, but is composed of different areas, acuity, understanding, discrimination and retention, each of which develops within itself at its own pace. It appears that in the present study, that children who can read well have already reached a fairly complex level of auditory discrimination. Wepman's test only measures short-term retention, so perhaps it might be advantageous to supplement the

Wepman Auditory Discrimination Test with further measures to assess auditory memory, including strength of auditory closure. It is further suggested that it might be possible to modify the Wepman Auditory Discrimination Test for administration with small groups by means of a clearly designed answer sheet, and the use of a tape recorder, which would probably increase test-reliability, and preserve fidelity of sound. In this way children with potential reading problems might be identified during the grade one year by the teacher and given remediation through graded listening exercises at this early stage.

5. The ability to concentrate has been shown to correlate highly not only with reading achievement, but visual and auditory perception and intelligence. It might be implied that the inclusion of many informal games to improve concentration in the primary program might produce not only better reading but an all round improvement in mental alertness in all subjects. These games would stress intensive visual or auditory attention for at first very short periods of time which would gradually be lengthened.

6. Teachers' ratings of personality characteristics correlate very highly with reading achievement. It seems possible that teacher-observations over a period of time, guided by carefully constructed check-lists, and recorded on well-structured rating scales, might give more valid assessments of progress in reading rather than reliance on scores of group tests which are only records of isolated observations.

## SUGGESTIONS FOR FURTHER RESEARCH

1. The findings of this study are now being tested with a larger

population in which reading achievement is normally distributed.

## SUMMARY

The present investigation examined the inter-relationships of visual and auditory perceptual, intellectual and personality factors with primary reading achievement. Few investigators up to the present have studied the relative contribution of several factors to reading achievement through the technique of multiple linear regression analysis. Only one other investigator (Halmquist, 1958) has considered the relationship of personality and perception with primary reading, and he did not include auditory discrimination together with visual perception as was done in the present study. It was found that significant relationships exist between several factors, perceptual, intellectual and personality, and reading achievement at the end of grade one. A battery consisting of The Marianne Frostig Developmental Test of Visual Perception, the Wepman Auditory Discrimination Test, and a teacher's rating for personality traits, particularly concentration, would seem to have merit for diagnosing perceptual and personality weaknesses which might underlie primary reading deficiencies. These measures could be used by classroom teachers, and point the way to specific and speedy remediation.

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