THE RELATIONSHIP OF SEQUENTIAL PART PRESENTATION OF FORM WITH HIGHER COGNITIVE PROCESSES

A Thesis

Presented to the

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Master of Arts

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by

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ABSTRACT

The basic purpose of this project is an attempt to relate certain higher cognitive processes to perception or integration of form. It was felt that if parts of a form were presented sequentially, the integration of the sequence in order to attain a percept would relate with performance on such cognitive tests as the DAT-SR, HN-IQ, EFT and RAT, either because of the integration process itself or/and because of common organizational factors inherent in both the forms and cognitive tests.

Three different types of stimuli were utilized; (a) meaningful forms, i.e. cube, (b) verbal forms, i.e. the word NUN, and (c) nonsense forms, i.e. no meaning, no symmetry. Lines of these figures were presented in sequence in a predetermined random order with increasing frequency from trial to trial. The frequency at which the figure was perceived or correctly identified was then correlated with performance on the various ability tests, and significant relationships were found with the DAT-SR, EFT and verbal IQ. For comparative purposes, threshold measures, of the same forms, obtained by means of tachistoscopic presentation were correlated with performance on the cognitive tests. No significant results were obtained using the t-scope data. It was concluded that the relationships found between the perception of form under the condition of sequential part presentation and the cognitive test were due to: (a) the integrative process, inasmuch as the S must retain and integrate a sequence of parts; (b) perceptual learning (in a "Hebbian" sense) as is the case with the nonsense figures and (c) common organizational factors inherent in both the forms and cognitive tests.

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CHAPTER I

INTRODUCTION

The main purpose of this study is to investigate the nature of some of the relationships between higher and lower orders of cognitive processes. The general experimental design closely parallels the one employed by Springbett, Dark and Clake (1957) and Springbett (1957) in their use of the Lines Test to make an exploratory investigation of creative thinking. The basic difference between the present study and the earlier ones is in the task confronting the Ss. In the studies done by Springbett et al., the task presented to the S was one of rote memory while in the present study it is perceptual.

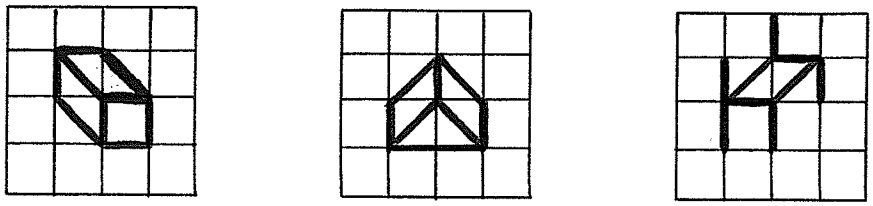
It should be noted that while the earlier studies were prompted by an interest in creative thinking, the factual results demonstrated only that there was a pattern of relationships between the rote memory task in the Lines Test and a series of conventional tests.

Because the rationale of the experimental design is basically the same in both of these approaches (perceptual and rote memory) a brief account of the earlier studies is indicated.

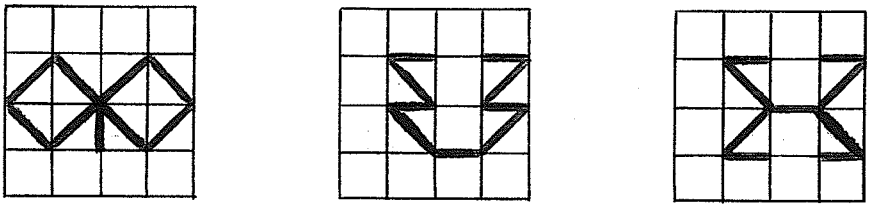
Springbett et al., (1957) constructed three different classes of line figures: meaningful (M - i.e. could be named e.g. box); Gestalt (G - symmetric but unfamiliar); nonsense figures (N - unsymmetrical, no closed parts and not familiar). (See Figure 1).

In the test situation, the S was shown the lines of a figure. The lines were presented one at a time and one every two seconds and each one in the appropriate position on a rectangular grid. After all the lines had been presented, the S was asked to draw all the lines he could remember on a single grid. A score of 1 was given for each line correctly

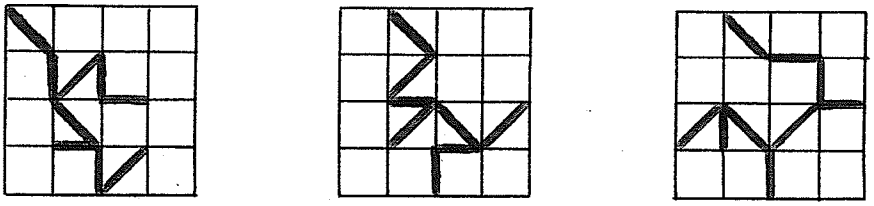
LINES TEST



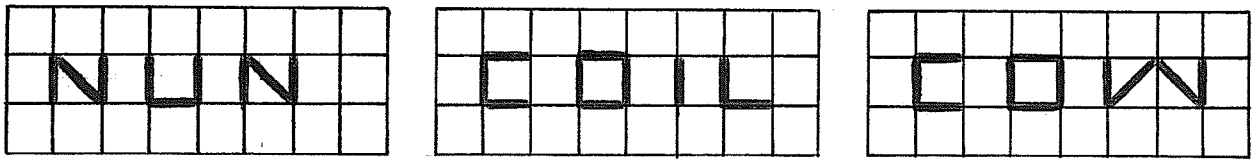
Meaningful Forms



Geometric Forms



Nonsense Forms



Verbal Forms

Figure 1

correctly placed. The scores on the particular figures in a class were then combined to represent the M, G and N scores. The investigators found significant differences in scores between the three classes of figures, with the score for the M figures being the highest and for the N figures the lowest.

The M, G and N scores were then correlated with such tests as the Otis IQ, DAT Spatial Relations Test, Abstract Reasoning Test and the Mooney Closure Test. M figures correlated significantly with all the tests; the G figures with the Otis Test of Mental Ability. The N figures did not correlate significantly with any of the tests.

In a follow up study (Springbett, 1957) a test was designed using words, i.e. verbal forms. (See Figure 1). This form of the Lines Test produced the highest correlations with verbal intelligence - higher than the correlation coefficient between the M figures and verbal intelligence.

Inasmuch as the Ss rarely were able to correctly reproduce all lines and insofar as the instructions to the Ss gave no hint of configuration, it is obvious that they were never aware of the organizations involved in the various forms. Yet since the scores on the M figures are highest and the N figures lowest, and since the relationship between the conventional test and the Lines Test is strongest where the organization in the forms is relevant to the conventional test as in the case of verbal forms and a verbal intelligence and since there was an absence of covariation between the various ability tests and the N figures where no meaningful organization is present, it becomes obvious that there was a utilization of organization involved in the various figures. Thus, the role of organization must act as an unconscious level. Quoting from Springbett et al. (1957):

> "The role of the unconscious organization is viewed as follows: it is assumed that the nine lines of a meaningful figure, separately presented, will partially activate the neural organization normally involved in perceiving such a figure; when the subject attempts to recall these lines they will be better remembered by virtue of their membership in this organization, provided that the subject is not dominated by his conscious processes but is sensitive to those which are unconscious." (p. 14)

One of the unexplored variables is the rate of presentation of the separate elements of the form or figure. When the possibility of testing the limits of the rate of presentation of the lines is considered, it becomes obvious that at a given rate apparent movement (AM) of the lines will emerge and at a still higher rate AM will cease and simultaneity and perception of form will occur. It is the purpose of this study to determine whether (a) the rate of presentation at which form perception occurs will differ with the different classes of figures and (b) whether individual differences at which integration or form perception occurs will be related to the individual differences on cognitive tests measuring abilities relevant to the corresponding structures embodied in the different classes of figures.

In the Lines Test with a rate of presentation of 1 line every 2 seconds rote memory and conceptual integration were necessary for successful performance on test items. In the present study with rapid rates of presentation the integration is of a perceptual character. Inasmuch as this experimental approach involves form perception via sequential part presentation (SPP) and also involves apparent movement (AM), consideration of these topics, as they relate to the thesis problem is indicated.

Form Perception by Way of Sequential Part Presentation

Excepting AM at the moment and considering rates of sequential part presentation (SPP) of form at which perceptual integration occurs, the process of integration may be thought of in terms of some brain model such

as Hebb's (1949). For instance, it may be supposed that each line activates part of a phase sequence or t-assembly or some other centrally located storage mechanism. After activation of the necessary number of these "units" integration occurs, in terms of Hebb's model, the "t-assembly" is activated (Hebb, 1949). The assumption is that SPP of form results in storing the parts centrally with subsequent integration being responsible for the percept (as opposed to retinal storage and retinal integration and subsequent transmission in a holistic sense). Theoretical and experimental developments furthering some type of operation of analysis and integration has come from such authors as Hebb, 1949; Hubel, D.H. and Wiesel, T.M., 1959; Deutsch, 1960; Dodwell, 1962; Sutherland, 1960, to name only some.

The feasibility of the assumption that in form perception parts are stored centrally with consequent integration being responsible for the percept, has been demonstrated by Parks (1965). Parks moved simple figures behind a narrow slit as small as 1/64" over periods of time ranging from 1/4 - 1/2 second. Ss actually saw the figure - at slower speeds they could only identify it. Retinal storage is unlikely since the eye is fixated and a small part of the retina must transmit all information quickly. Parks states:

> ".....components of storage is more central than the receptors and it possesses dynamic properties (the various slices of the figure must be reassembled in terms of some time-of-arrival coding)... Furthermore, the fact that at low speeds 0 may report the nature of the stimulus without reporting that he has seen it directly as a whole may provide the basis for an operational distinction between visual storage and short term storage proper". (p. 147)

In a different context and with a different purpose than applied to the present study, McFarland (1965) utilized sequential presentation of

lines in one case and angles in another of an equilateral triangle to determine frequency levels for non-joining and non-simultaneity. It was his purpose to develop an experimental method of stimulus presentation in accordance with the theoretical developments which view perception as a process of analysis and integration.

In both McFarland's (1965) and Parks' (1965) studies, a temporal factor is introduced in the perceptual tasks. The temporal factor serves to break up the stimulus into sequential parts. The S must somehow retain the sequence and integrate the same in order to achieve a percept of the stimulus. It is this integrative process of which SPP would be a measure.

This temporal factor as it applies to SPP is not involved in simultaneous presentation or tachistocopic (TP) presentation of form. It is possible, of course, that in the case of TP, form perception occurs as a result of serial coding and resultant integration. A threshold measure utilizing TP would not have a tendency to measure the integrative capacity of the visual system as would be the case in SPP since in the case of TP, the process of serial coding would occur in such a fashion where the temporal storage of serial signals would presumably be at a minimum and optimal for resultant integration or perception of form.

If frequency at which perception of form occurs in SPP is a measure of the integrative capacity of the visual system, it might be related to performance on other cognitive tests. This would stem from the fact that even though integration of sequential events in SPP is on a perceptual level, cognition also involves sequential orders and integration of such orders.

Apparent Motion

If experimental procedure in sequential presentation of lines of a figure is such where the frequency of lines/second is increased until the figure can be identified, the phenomena of apparent motion (AM) must be considered. If AM was simply dependent upon stimulus parameters (i.e. intensity, interstimulus interval, retinal separation, etc.) then one could simply view it as a complicating factor until the appropriate frequency is reached where analyses and integration can occur.

However, studies have shown that AM is related to such factors as meaning (Toch & Ittellson, 1956); directional information (Brown, 1956, Jeeves & Brumer, 1956, Jeeves, 1964); age and IQ (Pollock, 1965, Hamilton, 1960); and neuroticism (Hamilton, 1960).

Toch and Ittleson (1956) found that AM had a tendency to take that direction most in accord with the direction the stimulus would normally take (i.e. bomb falling downwards). Hamilton (1960) found smaller mean movement intervals for neurotics and that these mean movement intervals decreased with age.

Insofar as the task for the Ss is to perceive the stimulus figure at a minimum frequency of sequential presentation, it is possible that in the service of meaning the simultaneity threshold can be lowered. The extent to which AM can be "inhibited" or resolved in this experimental task may thus be related to a variety of higher cognitive processes.

CHAPTER II

METHOD

The most difficult technical problem was to find some means of sequentially presenting the elements of the Lines Test over a wide range of frequencies. The technical details of the apparatus are presented in the Appendix A. The whole conception and production of the apparatus was conducted by Mr. L. Bell (University of Manitoba). It will suffice to say here that each line component was produced by embedding a neon bulb in a clear plastic wedge and masking the wedge so as to have an illuminated slit when the bulb was lit. From an array of such units (for diagram see Appendix A) mounted on a panel, a multi-pole-multi-position switch was used to select the appropriate pattern which could be presented sequentially or simultaneously. Insofar as the apparatus precluded variation in sequence of line presentation of any form, the order within any figure was fixed for all Ss. Rates of line presentation could be varied from 6 lines/second to 115 lines/second. The off-on ratio was set at 1:1 irrespective of frequency. Ultra violet light was utilized to insure regular operation of neon lights.

The forms used are shown in Figure 2. The M figures are the same as those used in the original Lines Test. The type of words chosen was mainly dependent on technical considerations since in its present form all the patterns have to have the same number of line components (9 in each pattern) and all the patterns had to fit into the most economical arrangement possible. The N figures, although somewhat different from the Lines Test were constructed along the same principle, i.e. no enclosed parts, no symmetry, and lacking familiar pattern.

Figure 2

FORMS USED IN PERCEPTUAL TASK

MEANINGFUL FORMS (M)

Fig. 1*

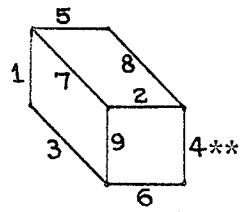


Fig. 2

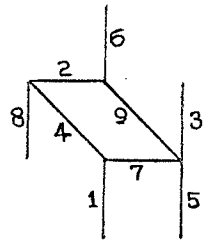
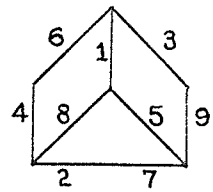


Fig. 3



VERBAL FORMS (V)

Fig. 6

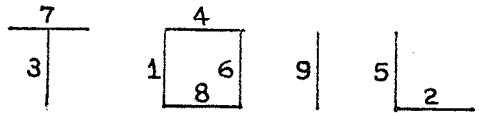


Fig. 5

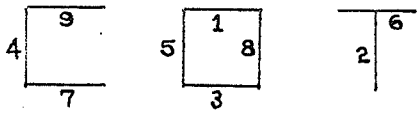
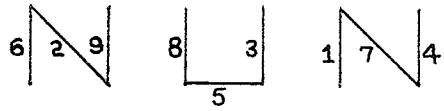


Fig. 4



NONSENSE FORMS (N)

Fig. 7

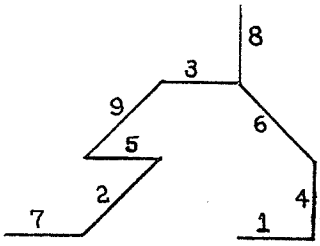


Fig. 8

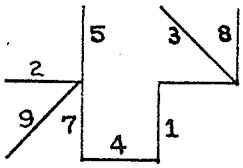
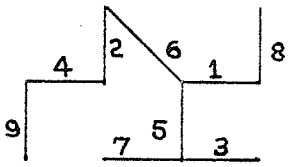


Fig. 9



* Fig. No.'s refer to variables 1 through 9 in complete correlation matrices in Appendix B (pp.).

** Numbers indicate sequence used in sequential part presentation of form.

Testing Materials

The main question being put by the experiment is whether individual differences in the ability to achieve perception of form from sequentially presented elements is associated with ability to manipulate material of a like category at the conceptual level. The Henmon Nelson Tests of Mental Ability, Revised Edition, Form A (HN) was selected as a measure of verbal abilities with the expectation that performance on it would be related to the performance on the V figures. On the basis of the findings on the Lines Test, it was expected that the Differential Aptitude Test of Space Relations, Form A (DAT) would relate with performance on the M and V figures and not with the N figures.

The short form of the Embedded Figures Test (EFT) was included in the battery on an intuitive basis. A M of the lines seemed to mask the elements and it appeared a reasonable analogy to think of the elements being embedded in a nexus of movement.

Form A of the Remote Association was included because the purpose of the Lines Test was to achieve a measure of creative thinking. The integration of the subordinate terms by way of common mediators has some analogy with the integration of elements in the verbal figures.

Subjects

Ninety three Ss - 55 males and 38 females from the Introductory Psychology Class at the University of Manitoba participated in this experiment (a more balanced number was intended but absenteeism and lack of female Ss resulted in present numbers). All Ss participating in this experiment were doing so in partial fulfillment of the course requirement of 5 hours of experimental work.

Procedure

Conventional Tests. All Ss reported for a group testing session. The HN, DAT and RAT were administered in that order. Instructions and procedures for each test followed, the directions accompanying each test. Times were carefully checked by a stopwatch. The tests were scored in accordance with standard procedure. The DAT and HN scores were not changed to percentiles but left in their raw form.

All Ss were tested individually when EFT and perceptual tasks were administered. The EFT was administered according to the standard directions accompanying the test (Witkin, 1954).

Perceptual Tests. The perceptual task was either of a simultaneous or sequential type. Ss were assigned alternately to each condition as they reported for this part of the experiment. In both conditions Ss were seated 5 feet from the apparatus. Insofar as the size of the forms were relatively large (see Appendix A) and insofar as AM in the sequential condition compels eye movement, no effort was made to control either eye movements or head movements.

The following instructions were given to Ss in the sequential condition:

> "In front of you, you see a piece of equipment which is capable of presenting lines of light one at a time and one after the other at a rapid rate. The lines of light during any presentation will form some type of line figure or form. You will be given 10 second trials during which the lines of light will go on and off sequentially and your job is to identify the form or figure by letting me know when you can see it. Once you see it, you can either name or draw it. Some forms you will not be able to name insofar as they form a collection of lines with little symmetry and no meaning. You may start drawing the form anytime you like, but once you start drawing you may not refer back to the apparatus until you are finished drawing. The 10 second trial will be repeated until you correctly name or draw the form being presented. You will find during the first few trials on a particular form you will have

difficulty in identifying the figure because of a condition known as apparent movement. You will find the lines appear to jump around or move from one spot to another just as is the case in neon signs or movies. As we continue from trial to trial you will see this will disappear and a stable form emerge. As soon as this happens please name or draw the figure. There will be several forms to do. Are there any questions?"

The following instructions were given to Ss in the t-scope condition:

"In front of you we have a piece of equipment which is capable of presenting line forms or figures for very short durations. Your job is to identify the figure shown during such an interval by either naming or drawing it. Some forms you will not be able to name as they will form a collection of lines with little symmetry and no meaning. If you cannot correctly identify it on the first trial we will try it again until you correctly identify it. There will be several forms to do. Are there any questions?"

In both conditions, forms were then presented in random order with the added restriction that no two forms from a particular class, i.e. verbal, meaningful and nonsense, would be presented consecutively.

The ultra violet light had an interesting side effect as some forms of white paper "light up" under this light without adding much to the general illumination of the room. Thus, both Ss and E could easily see what was being drawn with a minimum of experimental procedure.

In the sequential procedure the first trial of 10 second duration started with a frequency of 8 c/s. The frequency of each subsequent trial was increased by 4 c/s until S could either name or draw the figure. The frequency at which proper identification occurred was then recorded.

In the simultaneous condition duration of the first trial was 1 m.s. Subsequent trials were increased by 1 m.s. The duration at which proper identification occurred was then recorded.

CHAPTER III

RESULTS

For the perceptual measures 4 other scores were set up. Variables 10, 11 and 12 represent the summation of the scores on the M, V and N figures respectively. Variable 13 represents the sum of all 9 perceptual scores. For the cognitive variables IQ was broken down into numerical (14), verbal (15) and total (16) and were left in raw form as were the EFT scores. Varibales 17, 18 and 19 represent EFT, DAT-SR and RAT respectively. Data for variables 1 through 19 is listed in Appendix C.

Significant differences between M, V and N scores (variables 10, 11 and 12) were found in both the SPP and T conditions where $F = 9.65$; $df = 2,106$; $p < .05$ and $F = 85.56$; $df = 2,72$; $p < .05$ respectively. (See Tables 1 and 2 for analysis of variance - unweighted means solution) (Weiner, 1962). The same analysis also indicates no significant differences between males and females in both SPP and T conditions ($F = 1.09$; $df = 1,53$; $p > .05$ and $F < 1$ respectively) for performance on the M, V and N perceptual tasks.

Insofar as there was reason to suspect significant differences between males and females, at least on such measures as the EFT and the DAT-SR, both the SPP and T conditions were divided into two groups representing males and females. Complete correlation matrices were calculated for all four groups (See Appendix B). The relevant subsets of correlation coefficients are listed in Tables 3 through 6. Significance of correlation coefficients was determined by using a one-tailed t-test with confidence level set at $p < .05$. All significant coefficients are asterixed in Tables 3 through 6. As can be seen both the EFT and DAT-SR

correlate well with perceptual variables in SPP-male group (Table 3). Moreover in this group verbal IQ correlates significantly with verbal figures. None of the coefficients for the SPP-female group (Table 4) are significant.

For T condition-males (Table 5) a different pattern emerges. The DAT-SR correlates well with the perceptual scores but the EFT correlates significantly with the nonsense figures in the opposite to expected direction. Again, as in the SPP condition there are no significant correlations for the female group (Table 6).

In testing for differences in covariation between males and females (2 tailed t, $p > .05$), no significant differences could be found except for coefficients 18, 11 and 18, 13 which differed significantly in both SPP and T conditions. Except for the fact that coefficients 18, 11 and 18, 13 are highly dependent on each other (not only is variable 18 common to both but 11 is common to 13 since variable 13 is the sum of all perceptual scores), it is difficult to evaluate the meaning of these two significant differences. However, on the assumption that there is a high probability that by chance alone the odd significant difference of this kind can occur, there does not appear to be a difference in covariance between males and females. In addition to this, it was also found that males and females in both the SPP and T groups did not differ significantly on the EFT ($t = .436$; $N = 55$; $p > .05$ and $t = .713$; $N = 38$; $p > .05$ respectively) and the DAT-SR ($t = .179$; $N = 55$; $p > .05$ and $t = .370$; $N = 38$; $p > .05$ respectively).

In view of the lack of sex differences as discussed above, it was considered justifiable to combine males and females for each condition.

A complete correlation matrix for both the SPP and T group were calculated(Appendix B). The relevant subsets of correlation coefficients are listed in Tables 7 and 8. All correlation coefficients with EFT and DAT-SR are significant in SPP condition (Table 7). Also verbal IQ correlates significantly with V figures. None of the coefficients for the T condition except for 1 (RAT and N figures) are significant.

TABLE 1

ANALYSIS OF VARIANCE ON PERCEPTUAL SCORES
FOR THE SPP CONDITION - UNWEIGHTED MEANS SOLUTION

Sources of Variation	SS	df	MS	F
Between Ss		54		
A	1,631.7	1	1,631.7	1.09
Ss w. groups	791,209.6	53	1,492.8	
Within Ss		110		
B	42,855.0	2	21,427.5	9.65*
AB	1,870,288.8	2	935,144.4	421.52*
B x Ss w. groups	235,166.0	106	2,218.5	

*$p < .05$

TABLE 2

ANALYSIS OF VARIANCE ON PERCEPTUAL SCORES
FOR THE T CONDITION - UNWEIGHTED MEANS SOLUTION

Sources of Variation	SS	df	MS	F
Between Ss		37		
A	19.81	1	19.81	
Ss w. groups	4,732.95	36	131.47	
Within Ss		76		
B	5,003.77	2	2,501.88	85.56*
AB	3.81	2	1.91	
B x Ss w. groups	2,105.05	72	29.24	

*$p < .05$

TABLE 3

CORRELATION COEFFICIENTS BETWEEN PERCEPTUAL AND COGNITIVE VARIABLES

Sequential Part Presentation - Males

Cognitive Variables		Perceptual Variables Meaningful 10[a]	Verbal 11	Nonsense 12	Total (M+V+N) 13
Quantitative IQ	-14[a]	-.093	-.253	-.309	-.265
Verbal IQ	-15	-.197	-.414*	-.308	-.354*
IQ (Q+V)	-16	-.172	-.394*	-.360*	-.364*
EFT	-17	.360*	.462*	.420*	.474*
DAT-SR	-18	-.440*	-.641*	-.746*	-.718*
RAT	-19	.055	-.130	-.115	-.084

* t >1.708, N=27, p < .05

TABLE 4

CORRELATION COEFFICIENTS BETWEEN PERCEPTUAL AND COGNITIVE VARIABLES

Sequential Part Presentation - Females

Cognitive Variables		Perceptual Variables Meaningful 10[a]	Verbal 11	Nonsense 12	Total (M+V+N) 13
Quantitative IQ	-14[a]	.036	.065	-.233	-.060
Verbal IQ	-15	.119	-.265	-.016	-.079
IQ (Q+V)	-16	.111	-.190	-.105	-.088
EFT	-17	.099	-.082	.043	.031
DAT-SR	-18	-.263	-.019	-.349	-.251
RAT	-19	-.179	-.022	-.025	-.073

* t > 1.746, N=28, p < .05

NOTE: For complete correlation matrix see Appendix B. a - numbers refer to numbers in text and complete matrix in Appendix.

TABLE 5

CORRELATION COEFFICIENTS BETWEEN PERCEPTUAL AND COGNITIVE VARIABLES

Tachistoscopic Presentation - Males

Cognitive Variables		Perceptual Variables Meaningful 10[a]	Verbal 11	Nonsense 12	Total (M+V+N) 13
Quantitative IQ	-14[a]	.056	.201	.256	.225
Verbal IQ	-15	-.129	.030	.155	.121
IQ (Q+V)	-16	-.096	.127	.246	.198
EFT	-17	-.019	-.216	-.459*	-.359*
DAT-SR	-18	-.493*	-.647*	-.404*	-.570*
RAT	-19	-.172	.111	.117	.088

* $t > 1.706$, $N=18$, $P < .05$

TABLE 6

CORRELATION COEFFICIENTS BETWEEN PERCEPTUAL AND COGNITIVE VARIABLES

Tachistoscopic Presentation - Female

Cognitive Variables		Perceptual Variables Meaningful 10[a]	Verbal 11	Nonsense 12	Total (M+V+N) 13
Quantitative IQ	-14[a]	-.136	-.260	-.171	-.196
Verbal IQ	-15	.036	.087	-.161	-.071
IQ (Q&V)	-16	-.045	-.073	-.190	-.144
EFT	-17	.062	.096	.087	.090
DAT-SR	-18	.016	.062	.018	.029
RAT	-19	-.103	-.072	-.401*	-.288

* $t > 1.734$, $N=20$, $p < .05$

NOTE: For complete correlation matrix see Appendix B.
a - numbers refer to numbers in text and complete matrix in Appendix B.

TABLE 7

CORRELATION COEFFICIENTS BETWEEN PERCEPTUAL AND COGNITIVE VARIABLES

Sequential Part Presentation - Combined Males and Females

Cognitive Variables		Perceptual Variables Meaningful 10[a]	Verbal 11	Nonsense 12	Total (M+V+N) 13
Quantitative IQ	-14[a]	.079	-.106	-.220	-.111
Verbal IQ	-15	.053	-.313*	-.139	-.162
IQ (Q&V)	-16	.075	-.267*	-.203	-.166
EFT	-17	.260*	.252*	.318*	.335*
DAT-SR	-18	-.339*	-.382*	-.625*	-.551*
RAT	-19	-.044	-.055	-.072	-.068

*$t > 1.680$, $M=55$, $p < .05$

TABLE 8

CORRELATION COEFFICIENTS BETWEEN PERCEPTUAL AND COGNITIVE VARIABLES

Tachistoscopic Presentation - Combined Males and Females

Cognitive Variables		Perceptual Variables Meaningful 10[a]	Verbal 11	Nonsense 12	Total (M+V+N) 13
Quantitative IQ	-14	-.093	-.007	-.021	-.057
Verbal IQ	-15	.015	.067	-.042	-.001
IQ (Q&V)	-16	-.048	.007	-.046	-.037
EFT	-17	.044	-.047	-.125	-.074
DAT-SR	-18	-.137	-.279	-.151	-.196
RAT	-19	-.104	-.002	-.240	-.176

NOTE: For complete correlation matrix see Appendix B.

a - numbers refer to numbers in text and complete matrix in Appendix B.

CHAPTER IV

DISCUSSION

As can be seen in Tables 1 and 2, significant differences in scores between the different classes of figures does occur. These differences occur both in the SPP and T conditions. These differences may reasonably be viewed as a function of the familiarity or meaning of the different classes of perceptual test items. Insofar as the N figures have no meaning and are unfamiliar a learning task is introduced which could account for the increase in the associated scores.

Still another factor which may be a relevant variable in determining the difficulty of the perceptual task, is the spatial separation between lines in the various figures used in SPP. The N figures are, on the average, spread over a larger area than the M or V figures. In as much as the spatial separation of lines is an independent variable in the production of AM, the temporal range over which AM may occur in the N figures may be larger than in the other two classes, making the task of integration more difficult.

The main purpose of the study was to determine whether the findings of the earlier studies involving conceptual integration could be reduplicated by data secured by way of perceptual integration. Confining the discussion to the results of statistical significance in the present study, it may be said that the results conform to those of the earlier study with one striking exception. Unlike the results of Springbett et al. (1957) it is the N figures which on the whole correlate better with the cognitive variables than the M and V figures. This, together with the fact that the T data for N figures is not significantly related to the

various cognitive factors, calls for some discussion.

It is assumed that where familiar figures are used the task of recognition and reproduction is easy. It is only the sequential presentation of parts that introduce some measure of difficulty into the task. With the N figures, however, there is no neural organization ready to provide the basis for recognition. This consideration suggests that the difficulty of the N tasks is due to the necessity for building up a phase sequence before reproduction of the figure can be mastered. This task is made more difficult by the sequential presentation of parts because a temporal as well as spatial organization must be achieved. It is contended that it is these requirements of the N figure task that accounts for its covariation with relevant cognitive tests.

In the original Lines Test, there was sequential presentation of parts but as this was only a single presentation of each line, the conditions were not provided for the establishment of a neural pattern such as a phase sequence. In fact, as far as the N figures are concerned in the Lines Test the task consisted mainly of rote memory and as such would not be expected to covary with higher cognitive processes to any large extent.

In the T scope presentation, the normal or natural conditions for establishing a neural organization or phase sequence were present, but the demand for temporal organization was not. All this suggests that for a perceptual task to simulate a higher cognitive task a neural organization such as a phase sequence is required together with the requirement of temporal organization imposed by the sequential presentation of parts.

To summarize to this point, it has been suggested that, in general, the covariance between performance on SPP tasks and the various other cognitive tests, stems from (a) the integrative process in as much as S must retain a sequence of parts and integrate the sequence into a percept and (b) perceptual learning as is the case with the N figures. There are two other factors which may further the covariance between SPP performance and performance on ability tests but have not so far been mentioned, since their apparency is more dependent on a detailed look at the results. The two factors are the relationships between the organization inherent in the patterns and similar organizational factors involved in the various cognitive tasks and the possibility of conceptual integration.

It was expected that an important variable, in conjunction with the requirements of SPP, would be the fact that the different cognitive tests were measuring abilities relevant to the corresponding meaningful structures embodied in the different classes of figures (hence the use of the N figures). In SPP, organization as such does play a role. In the case of the V figures for instance performance on same is the only perceptual task to correlate to a significant degree with performance on the verbal section of the HN IQ test. Similarly performance on the EFT and DAT-SR covary well with the V and M figures as expected. However, in view of the fact that N figures correlate well with the various cognitive tasks, meaningful organization is only one factor that plays a role, and other variables such as a temporal integration and perceptual learning appear to be important as have been mentioned.

After a S was subjected to a number of trials it is possible that despite AM, the S could infer the position of the lines and identify the

form or figure. Indeed, on some of the more familiar figures like the cube or some words a few Ss did identify the particular form before simultaneity occurred for them. It is possible that the ability to abstract the correct form from a moving context is an important factor that contributes to the covariance between the perceptual and cognitive scores. And as can be seen in Tables 3 and 7, the coefficients for the perceptual scores and the EFT are all significant. It is also the EFT where, although there are qualitative differences, abstraction of form, complicated by context, is required. Although this abstraction of form seems likely to be involved in the more familiar figures, it appears unlikely that this could occur, or at least only to a small degree, with the N figures. Insofar as the N figures are difficult and insofar as there is no present underlying neural organization which could serve as the basis for abstraction of form, conceptual as opposed to perceptual integration is unlikely.

Methodological Considerations

Intercorrelations of the scores for the 9 perceptual items in the SPP condition (Appendix B) indicates that reliability is rather low in as much as the correlation coefficients are small even within a class. (In apprehension of this fact, scores within a class were combined). Two factors depressing these correlations are (1) method of threshold determination and (2) the possibility of practice effect.

(1) Thresholds are normally subject to variability and the usual procedure for quantitatively defining a threshold involves a mean, mode or some other mathematical derivative of a measured range, usually representing a more reliable value. This was not the case in the present project where threshold was simply defined as that value at which an item

was first perceived or properly identified.

(2) Insofar as the perceptual items were prescribed in a random order the same item for different Ss was influenced by different amounts of previous practice. In fact, it appears that practice effect may be the main factor responsible for the lower correlations between perceptual items in SPP. For instance, in the intercorrelation coefficients of the scores on the 9 items are compared between the SPP on T conditions, the coefficients on the average are much higher for the T condition. Since the method of threshold determination in both conditions are essentially the same, another variable must account for the lower coefficients in the SPP matrix. It appears likely that this variable is practice effect.

In future studies of this nature methodological modifications for both threshold determination and practice effect should be incorporated. A study is presently underway to both control and study the effects of practice.

An Incidental Finding

One of the interesting facts encountered in this study is why there were no sex differences in the raw scores on the DAT-SR and EFT when they have been consistently found elsewhere (Witkin, 1954; Bennet, Seashore & Wesman, 1952; Sherman, 1967; and others). The first possibility appears to be a peculiar sampling of males and females and/or a peculiar population of freshman at the University of Manitoba.

Two other studies done at the University of Manitoba during the same academic year involving EFT (Ss in those studies were not involved in this project) demonstrated no sex differences on this test although sample size was considerable in each case (27m, 27f; 30m, 30f) (Pressey-personal communications). These results suggest that our population, not

the sampling, at least over the past academic year, exhibited peculiar characteristics.

As far as the DAT-SR is concerned, evidence exists that in terms of raw scores the sex differences diminishes in university. (Bennet, Seashore & Wesman, 1952). In one follow up study (College students were tested in high school) the mean percentile scores for SR are as follows:

Group	Men	Women
Science	67	81
Arts	61	69

(From Tables 21 and 22, pp. 60 - 61)

The higher percentile score for females indicates a diminishing difference in raw scores between males and females. It is feasible that cultural change since inception of the test and establishment of norms have had an effect in minimizing male-female differences. It has also been argued (J. Sherman, 1967) that EFT is primarily a measure of spatial ability and since Ss demonstrated no sex differences on DAT-SR, none on the EFT can be expected.

Lines of Further Research

In summary it may be said that perception of form, by means of sequential part presentation, has demonstrable relationships with higher cognitive processes. It has been postulated that both the temporal integration and the role of organization plays important parts in these relationships. The investigation and explication of these results have led to several possible lines of future research. For instance, in as much as the present form of the Lines Test covaried with various abilities it could be interesting to see how with certain modifications it would

function in a developmental study. Or it might prove of value to see if SPP can have any use in detecting brain damage.

Another possibility that raises itself is how this type of approach can be utilized for a relatively "culture free" indicant of intelligence. Figures such as the N figures may prove useful here.

Various aspects of AM per se may be studied. For instance, if meaning can facilitate simultaneity, can it in another situation serve to inhibit simultaneity or facilitate AM. Similar questions may be asked about the successiveness-movement threshold.

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APPENDIX A

DESCRIPTION OF APPARATUS

The main components of the apparatus can be described as a display unit, control unit and a Hunter Interval Timer (HIT). (Bell personal communication).

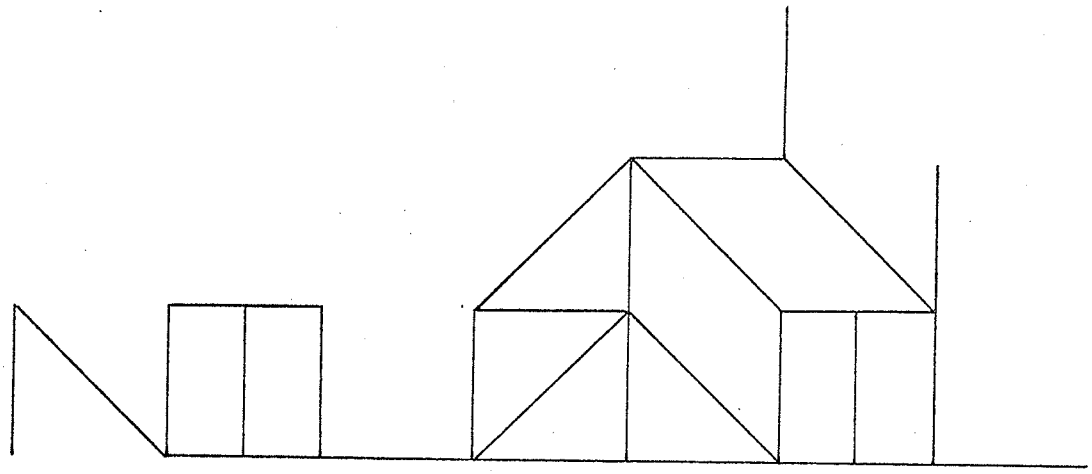
The display unit contains the 9 stimuli or figures to be presented to the Ss (see Figure 3). Associated with the display unit is a multipole-multiposition switch to select the group of lights comprising each figure as required (see Figure 3) and the electronic circuitry of a neon glow lamp ring counter (Manley & Buckly, 1950: G.E. Glow Lamp Manual, 1956). The neon glow lamps - YAC, ME 97 (G.E. Glow Lamp Manual, 1956) - are housed in clear plexiglass with visible face dimensions of 2" x 1/16 and 2 2" x 1/16 (see Figure 3). The rest of the housing has an undercoat of white and a surface coat of black to prevent both visibility and loss of light.

The control unit, operated from 117V, 60HS (c/s) source provides a regulated D.C. voltage to energize the neon lights. A SCR operated multivibrator provides a 70V square wave signal to fire and extinguish each neon light in turn. A multipole-multiposition switch was used to control changes in frequency in either steps of 3, 4 or 5 c/s. The on/ ratio was set at 1:1. In the t-scope condition (i.e. simultaneous presentation of all lines in a particular figure) a switch was used which rendered the square wave generator inoperative and a large pulse is directed to all lamps.

The HIT was used to control trial interval for both the sequential and t-scope conditions.

Figure 3

APPARATUS - FACE VIEW



INDIVIDUAL LAMP

Dimensions of light emitting surface:

Width 1/8"

Length 2"; diagonal lamps $2\sqrt{2}$".

During the operation of apparatus a cource of ultra-violet light was used. Insofar as the neon lights are photosensitive, the uv light served to insure regular sequential operation (Engel & Howat, 1966).

APPENDIX B

TABLE I

COMPLETE CORRELATION MATRIX - SEQUENTIAL CONDITION - MALE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2	.167																		
3	.217	.521																	
4	.163	.283	.597																
5	.134	.183	.381	.027															
6	.294	.208	.291	.384	.234														
7	.269	.153	.390	.377	.296	.524													
8	.108	.376	.435	.420	.403	.500	.465												
9	.336	.384	.500	.588	.320	.483	.317	.420											
10	.626	.781	.784	.468	.314	.351	.361	.417	.557										
11	.290	.313	.572	.632	.565	.855	.589	.633	.652	.525									
12	.293	.403	.568	.593	.443	.643	.732	.846	.742	.573	.804								
13	.435	.544	.715	.650	.508	.717	.668	.755	.755	.767	.898	.937							
14	-.076	-.016	-.104	-.370	-.006	-.171	-.330	-.238	-.167	-.093	-.253	-.309	-.265						
15	-.252	-.035	-.179	-.291	-.010	-.501	-.481	-.203	-.073	-.197	-.414	-.308	-.354	.473					
16	-.198	-.030	-.168	-.382	-.010	-.403	-.478	-.255	-.136	-.172	-.394	-.360	-.364	.838	.877				
17	.373	.145	.255	.190	.466	.351	.286	.424	.247	.360	.462	.420	.474	-.068	-.300	-.223			
18	.297	-.265	-.401	-.453	-.393	-.509	-.477	-.755	-.441	-.440	-.641	-.746	-.718	.196	.336	.315	-.730		
19	.006	-.147	-.034	-.134	.099	-.191	-.153	.067	-.221	.055	-.130	-.115	-.084	.385	.273	.379	.168	-.058	

Variables:
1,2,3 - Meaningful Figures
4,5,6 - Verbal Figures
7,8,9 - Nonsense Figures
10 - Sum of M Figures
11 - Sum of V Figures
12 - Sum of N Figures
13 - Sum of All Figures
14 - Quantitative IQ
15 - Verbal IQ
16 - IQ (Q&V)
17 - EFT
18 - DAT-SR
19 - RAT

TABLE II

COMPLETE CORRELATION MATRIX - SEQUENTIAL CONDITION - FEMALES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2	.410																		
3	-.104	-.003																	
4	.289	.353	.025																
5	.031	.363	-.195	.252															
6	.145	.413	-.037	-.062	.195														
7	.420	.589	-.164	.488	.404	.146													
8	.175	.294	.043	.344	.086	.113	.343												
9	.029	.493	-.002	.028	.024	.423	.015	-.180											
10	.619	.680	.552	.323	.036	.253	.357	.308	.242										
11	.239	.589	-.100	.530	.689	.700	.310	.268	.295	.326									
12	.338	.722	-.058	.477	.271	.200	.731	.712	.379	.491	.468								
13	.488	.843	.146	.542	.451	.531	.571	.529	.390	.747	.790	.810							
14	-.211	.091	.085	-.197	.294	.036	-.259	-.275	.150	.036	.065	-.232	-.060						
15	.001	.062	.045	-.100	.060	-.385	.171	-.152	-.017	.119	-.265	-.016	-.079	.279					
16	-.083	.087	.070	-.160	.165	-.299	.036	-.233	.046	.111	-.190	-.105	-.088	.625	.924				
17	.203	-.088	.068	.073	-.445	.132	-.096	.189	-.052	.099	-.082	.043	.031	-.616	-.314	-.500			
18	-.115	-.258	-.164	-.044	.393	-.214	-.162	-.298	-.166	-.263	-.019	-.349	-.251	.334	.469	.514	-.382		
19	-.118	-.008	-.380	-.055	-.022	.088	-.104	-.015	.078	-.179	.022	-.025	-.073	.317	.331	.395	-.065	.267	

Variables:
1,2,3 - Meaningful Figures
4,5,6 - Verbal Figures
7,8,9 - Nonsense Figures
10 - Sum of M Figures
11 - Sum of V Figures
12 - Sum of N Figures
13 - Sum of All Figures
14 - Quantitative IQ
15 - Verbal IQ
16 - IQ (Q&V)
17 - EFT
18 - DAT-SR
19 - RAT

TABLE III

COMPLETE CORRELATION MATRIX - TACHISTOSCOPIC CONDITION - MALES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2	.468																		
3	.088	.389																	
4	.665	.474	.152																
5	.745	.528	.271	.819															
6	.184	.055	-.096	.499	.331														
7	.281	.387	.270	.514	.658	.300													
8	.841	.404	.115	.411	.652	.002	.232												
9	.327	.098	-.082	.349	.354	-.070	.068	.184											
10	.420	.814	.842	.422	.534	-.009	.403	.385	.039										
11	.692	.473	.175	.945	.919	.615	.614	.496	.305	.439									
12	.653	.400	.168	.597	.819	.151	.680	.627	.615	.342	.693								
13	.731	.581	.310	.801	.926	.284	.721	.631	.535	.584	.863	.921							
14	.203	-.076	.108	.122	.262	.080	.083	.103	.263	.056	.201	.256	.225						
15	-.028	.052	-.239	.033	.057	-.049	-.178	-.025	.574	-.128	.030	.155	.121	.180					
16	.083	-.048	-.129	.101	.172	-.004	-.109	.048	.563	-.096	.127	.246	.198	.667	.843				
17	-.245	-.116	.112	-.271	-.299	.188	-.260	-.132	-.439	-.019	-.216	-.459	-.359	-.400	-.348	-.496			
18	-.316	-.315	-.464	-.685	-.551	.362	-.538	-.303	.012	-.493	-.647	-.404	-.570	.312	.260	.324	-.150		
19	.256	-.005	-.319	.176	.123	-.097	-.326	.295	.361	-.172	.111	.117	.088	.099	.646	.575	-.375	.159	

Variables:
1,2,3 - Meaningful Figures
4,5,6 - Verbal Figures
7,8,9 - Nonsense Figures
10 - Sum of M Figures
11 - Sum of V Figures
12 - Sum of N Figures
13 - Sum of All Figures
14 - Quantitative IQ
15 - Verbal IQ
16 - IQ (Q&V)
17 - EFT
18 - DAT-SR
19 - RAT

TABLE IV

COMPLETE CORRELATION MATRIX - TACHISTOSCOPIC CONDITION - FEMALE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2	.867																		
3	.727	.755																	
4	.688	.645	.757																
5	.960	.909	.784	.720															
6	.684	.665	.809	.746	.707														
7	.184	.329	.376	.164	.329	.385													
8	.443	.561	.374	.322	.502	.287	-.080												
9	.575	.572	.455	.712	.581	.533	.036	.402											
10	.904	.961	.897	.742	.940	.772	.345	.514	.573										
11	.845	.804	.864	.925	.881	.903	.313	.401	.681	.894									
12	.622	.741	.626	.655	.727	.649	.538	.569	.797	.734	.745								
13	.786	.864	.791	.786	.867	.785	.483	.562	.779	.888	.894	.957							
14	-.215	-.127	-.085	-.279	-.090	-.313	.042	.089	-.356	-.136	-.260	-.171	-.196						
15	-.063	-.077	.239	.130	.035	.058	-.048	-.115	-.148	.036	.087	-.161	-.071	.512					
16	-.144	-.113	.112	-.055	-.023	-.119	-.010	-.030	-.274	-.045	-.073	-.190	-.144	.831	.903				
17	.028	.040	.097	.010	.057	.205	.244	.001	-.073	.062	.096	.087	.090	-.070	-.268	-.208			
18	.124	.008	-.026	.039	.137	.003	.078	-.014	-.031	.016	.062	.018	.029	.403	.471	.506	.597		
19	-.050	-.179	.001	-.014	-.066	-.125	-.306	-.010	-.365	-.103	-.072	-.401	-.288	.390	.302	.390	.283	.024	

Variables:
1,2,3 - Meaningful Figures
4,5,6 - Verbal Figures
7,8,9 - Nonsense Figures
10 - Sum of M Figures
11 - Sum of V Figures
12 - Sum of N Figures
13 - Sum of All Figures
14 - Quantitative IQ
15 - Verbal IQ
16 - IQ (Q&V)
17 - EFT
18 - DAT-SR
19 - RAT

TABLE V

COMPLETE CORRELATION MATRIX - SEQUENTIAL CONDITION - MALES AND FEMALES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2	.305																		
3	.074	.268																	
4	.235	.338	.292																
5	.083	.260	.071	.140															
6	.222	.302	.114	.151	.215														
7	.347	.392	.155	.437	.330	.218													
8	.134	.321	.245	.377	.268	.334	.409												
9	.220	.416	.272	.340	.197	.452	.212	.217											
10	.624	.749	.675	.405	.164	.289	.397	.353	.418										
11	.268	.442	.226	.578	.623	.780	.463	.481	.508	.420									
12	.311	.514	.312	.529	.365	.464	.726	.796	.635	.533	.668								
13	.463	.675	.463	.596	.468	.623	.644	.666	.630	.758	.840	.895							
14	-.072	.131	.058	-.221	.094	-.081	-.191	-.229	-.043	.079	-.106	-.220	-.111						
15	-.085	.088	.005	-.146	.021	-.421	-.088	-.167	-.032	.053	-. 313	-.139	-.162	.428					
16	-.094	.124	.031	-.208	.061	-.330	-.154	-.226	-.043	.075	-.267	-.203	-.166	.782	.898				
17	.311	.061	.177	.143	.104	.259	.160	.346	.155	.260	.252	.317	.335	-.194	-.265	-.277			
18	-.222	-.238	-.276	-.266	-.083	-.386	-.349	-.616	-.352	-.339	-.382	-.625	-.551	.230	.373	.370	-.619		
19	-.047	.076	-.205	-.086	.038	-.052	-.116	.032	-.094	-.044	-.055	-.072	-.068	.306	.378	.076	.073		

Variables:
1,2,3 - Meaningful Figures
4,5,6 - Verbal Figures
7,8,9 - Nonsense Figures
10 - Sum of M Figures
11 - Sum of V Figures
12 - Sum of N Figures
13 - Sum of All Figures
14 - Quantitative IQ
15 - Verbal IQ
16 - IQ (Q&V)
17 - EFT
18 - DAT-SR
19 - RAT

TABLE VI

COMPLETE CORRELATION MATRIX - TACHISTOSCOPIC CONDITION - MALES AND FEMALES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2	.797																		
3	.542	.642																	
4	.635	.583	.525																
5	.695	.673	.512	.740															
6	.571	.544	.532	.658	.507														
7	.193	.338	.340	.278	.442	.363													
8	.496	.524	.288	.354	.529	.212	.010												
9	.479	.475	.295	.580	.449	.397	.041	.337											
10	.824	.938	.856	.640	.693	.612	.356	.485	.459										
11	.729	.690	.597	.930	.876	.780	.410	.430	.552	.744									
12	.586	.662	.476	.629	.719	.521	.577	.584	.746	.652	.721								
13	.733	.803	.638	.779	.822	.665	.544	.579	.719	.821	.872	.947							
14	-.156	-.118	-.008	-.127	.102	-.177	.050	.076	-.137	-.093	-.070	-.021	-.057						
15	.032	-.018	.043	.111	.031	.022	-.083	-.055	.053	.015	.067	-.042	-.001	.300					
16	-.066	-.087	.022	.013	.068	-.082	-.040	.003	-.039	-.048	.007	-.046	-.037	.734	.864				
17	.001	.001	.103	-.106	-.153	.188	.044	-.040	-.201	.044	-.047	-.125	-.074	-.247	-.261	-.322			
18	.021	-.085	-.228	-.298	-.277	-.131	-.170	-.124	-.019	-.137	-.279	-.151	-.196	.336	.362	.414	-.335		
19	.044	-.125	-.109	.066	.016	-.116	-.305	.093	-.179	-.104	-.002	-.240	-.176	.248	.448	.461	.014	.089	

Variables:
1,2,3 - Meaningful Figures
4,5,6 - Verbal Figures
7,8,9 - Nonsense Figures
10 - Sum of M Figures
11 - Sum of V Figures
12 - Sum of N Figures
13 - Sum of All Figures
14 - Quantitative IQ
15 - Verbal IQ
16 - IQ (Q&V)
17 - EFT
18 - DAT-SR
19 - RAT

APPENDIX C

TABLE VII

RAW DATA FOR MALES - SEQUENTIAL CONDITION

S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
AM01	24	44	36	32	40	36	40	40	48	104	108	128	340	28	47	75	408	82	26
AM02	32	28	40	40	36	52	52	44	64	100	128	160	388	14	39	53	445	50	6
AM03	24	32	36	36	36	40	52	56	32	92	112	140	344	29	39	68	1104	12	20
AM04	36	44	40	32	28	28	48	40	48	120	88	136	344	31	41	72	456	44	24
AM05	16	32	36	28	28	32	36	24	20	84	88	80	252	34	48	82	396	95	21
AM06	20	44	36	24	24	36	44	28	36	100	84	108	292	18	35	53	360	78	10
AM07	20	28	40	40	16	32	36	28	32	88	88	96	272	21	29	50	444	81	13
AM08	12	36	24	20	20	16	44	20	20	72	56	84	212	28	47	75	379	83	20
AM09	16	32	40	32	28	20	40	40	40	92	80	120	292	21	52	73	808	51	13
AM10	16	40	32	32	20	20	16	20	36	88	72	72	232	35	51	86	99	76	19
AM11	32	32	20	12	16	28	20	36	24	84	56	80	220	37	52	89	276	90	16
AM12	24	32	44	36	32	20	44	44	40	100	88	128	316	29	49	78	333	78	14
AM13	28	32	32	28	16	20	44	28	36	92	64	108	264	21	29	50	534	77	15
AM14	16	16	20	20	28	8	24	28	20	52	56	72	180	17	45	62	281	72	12
AM15	40	36	32	28	28	44	52	32	40	108	100	124	332	23	41	64	801	52	10
AM16	32	20	28	32	12	20	48	20	16	80	64	84	228	22	33	55	171	81	17
AM17	8	24	20	32	12	32	40	28	44	52	76	112	240	35	47	82	96	83	8
AM18	16	36	40	28	28	36	36	56	36	92	92	128	312	25	37	62	802	33	20
AM19	16	44	36	40	32	40	56	68	40	96	112	164	372	11	31	42	222	43	10
AM20	16	40	28	24	28	24	40	40	20	84	76	100	260	20	38	58	400	78	16
AM21	16	24	28	20	24	40	52	48	28	68	84	128	280	25	42	67	238	67	21
AM22	16	24	28	16	32	16	36	20	32	68	64	88	220	32	45	77	173	96	14
AM23	24	36	32	40	16	44	44	60	44	92	100	148	340	23	40	63	746	26	22
AM24	28	44	40	36	24	56	48	44	44	112	116	136	364	22	22	44	653	45	7
AM25	20	36	44	24	36	36	52	48	32	100	96	132	328	40	39	79	417	47	13
AM26	24	52	44	36	20	12	40	48	44	120	68	132	320	25	54	79	244	64	15
AM27	32	36	32	28	44	32	44	48	44	100	100	136	336	29	34	63	1454	28	19

TABLE VIII

RAW DATA FOR FEMALES - SEQUENTIAL CONDITION

S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
AF01	28	36	16	32	36	24	48	36	24	80	92	108	280	20	50	70	315	74	19
AF02	24	24	20	28	20	28	36	36	32	68	76	104	248	23	49	72	602	64	19
AF03	12	12	36	16	16	12	24	16	24	60	44	64	168	27	34	61	189	66	10
AF04	16	28	32	28	36	48	32	56	32	76	112	120	308	22	22	44	543	67	14
AF05	28	16	28	16	16	12	40	56	24	72	44	120	236	9	39	48	666	53	8
AF06	20	40	40	45	28	28	44	52	28	100	101	124	325	15	42	57	445	66	11
AF07	24	16	16	40	32	12	40	40	24	56	84	104	244	18	34	52	390	80	19
AF08	12	36	32	24	36	24	48	40	36	80	84	124	288	21	50	71	416	74	23
AF09	24	28	36	40	28	32	44	44	28	88	100	116	304	18	25	43	704	48	11
AF10	16	36	12	28	40	36	48	28	40	44	104	116	266	17	22	39	306	59	8
AF11	16	32	24	20	28	28	32	36	36	72	76	104	252	28	48	76	306	73	22
AF12	12	20	32	20	16	40	20	20	44	64	76	84	224	19	46	65	544	78	20
AF13	36	36	32	28	16	48	32	36	36	104	92	104	300	18	27	45	763	62	16
AF14	8	8	40	24	24	12	28	24	32	56	60	84	200	21	39	60	594	76	18
AF15	8	16	32	20	20	44	28	48	24	58	84	100	242	19	29	48	332	59	19
AF16	20	36	40	36	20	32	36	40	48	96	88	124	308	16	23	39	485	23	5
AF17	24	36	32	28	40	44	28	44	36	92	112	108	312	31	27	58	286	65	19
AF18	28	40	44	32	24	24	48	44	32	112	80	124	316	18	42	60	747	52	10
AF19	32	36	28	32	32	48	48	36	44	96	112	128	336	22	41	63	240	54	21
AF20	16	32	20	24	12	40	36	44	40	68	76	120	264	16	17	33	936	24	20
AF21	28	36	32	20	28	36	40	28	40	96	84	108	288	22	39	61	447	63	15
AF22	28	32	28	32	24	36	40	36	44	88	92	120	300	15	32	47	563	67	16
AF23	16	40	32	40	28	24	44	48	48	88	92	140	320	27	51	78	205	66	18
AF24	20	32	24	20	32	32	36	36	44	76	84	116	276	25	38	63	159	90	13
AF25	20	28	40	28	40	40	40	32	32	88	108	104	300	21	34	55	359	72	4
AF26	24	24	36	36	20	12	40	36	32	84	68	108	240	24	36	60	319	74	14
AF27	20	32	40	12	24	32	36	36	36	92	68	108	268	26	46	72	276	48	11
AF28	20	36	32	28	24	24	48	44	32	88	76	124	288	23	35	58	108	49	19

TABLE IX

RAW DATA FOR MALES - TACHISTOSCOPIC CONDITION

S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
BM01	1	3	2	2	2	3	4	4	7	6	7	15	28	19	31	50	410	70	13
BM02	1	4	2	1	1	1	4	4	14	7	3	22	32	27	49	76	317	90	19
BM03	1	2	1	1	1	2	5	6	17	4	4	28	36	21	45	66	361	70	10
BM04	1	2	6	1	1	1	3	3	8	9	3	14	26	33	33	66	194	76	7
BM05	1	1	1	2	3	2	6	5	6	3	7	17	27	31	42	73	285	84	19
BM06	1	2	2	3	2	4	3	4	16	5	9	23	37	32	50	82	120	86	22
BM07	1	5	6	2	2	2	10	5	5	12	6	20	38	22	36	58	379	46	11
BM08	1	4	5	5	7	3	21	6	12	10	15	39	64	27	34	61	340	12	6
BM09	2	4	3	3	6	2	9	17	10	9	11	36	56	28	34	62	361	65	16
BM10	1	1	2	1	1	1	6	2	16	4	3	24	31	26	31	57	300	90	10
BM11	2	5	3	9	8	4	12	9	18	10	21	39	70	28	39	67	50	17	16
BM12	1	1	2	3	1	2	3	6	7	4	6	16	26	19	35	59	317	24	18
BM13	1	2	1	2	1	4	15	2	2	4	7	19	30	22	30	52	323	63	6
BM14	1	3	1	2	1	3	4	4	5	5	6	13	24	34	29	63	389	93	7
BM15	1	4	2	2	1	1	3	5	5	7	4	13	24	15	32	47	435	69	13
BM16	1	2	4	2	1	4	2	4	4	7	7	10	24	21	28	49	1335	37	7
BM17	1	3	2	2	3	3	4	3	9	6	8	16	30	23	47	70	449	77	12
BM18	1	3	2	3	1	2	5	3	11	6	6	9	31	22	42	64	542	67	13

TABLE X

RAW DATA FOR FEMALES - TACHISTOSCOPIC CONDITION

S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
BF01	3	6	7	10	5	8	9	9	29	16	23	47	86	17	49	66	453	73	12
BF02	1	1	1	3	1	2	3	3	4	3	6	10	19	27	43	70	597	84	23
BF03	2	7	5	4	4	5	38	5	6	14	13	49	76	24	38	62	623	73	3
BF04	3	10	5	4	5	5	5	19	27	18	14	51	83	23	34	57	375	64	7
BF05	2	7	4	5	3	2	3	9	14	13	10	26	49	20	41	61	634	19	13
BF06	1	1	1	1	1	2	5	1	7	3	4	13	20	21	49	70	77	91	5
BF07	1	2	1	3	2	1	1	12	2	4	6	15	25	25	45	70	550	71	18
BF08	1	2	1	1	1	1	8	1	1	4	3	10	17	19	41	60	318	77	14
BF09	1	3	2	3	2	1	7	5	6	6	6	18	30	36	52	88	130	93	26
BF10	3	6	5	4	4	4	6	10	5	14	12	21	47	27	43	70	597	84	23
BF11	1	1	4	1	2	1	11	5	2	6	4	18	28	34	52	86	651	56	18
BF12	1	1	1	2	1	1	2	7	3	3	4	12	19	28	35	63	198	62	10
BF13	1	2	5	4	1	3	4	3	1	8	8	8	24	18	43	61	244	56	19
BF14	1	1	1	4	1	1	7	1	26	3	6	34	43	16	32	48	435	56	6
BF15	1	1	1	1	1	1	5	15	7	3	3	27	33	19	32	51	353	60	13
BF16	1	1	1	1	1	1	5	4	6	3	3	15	21	30	43	73	494	83	14
BF17	4	7	4	5	6	3	7	5	14	15	14	26	55	18	37	55	293	79	16
BF18	1	2	1	1	1	1	2	1	2	4	3	5	12	21	35	56	235	68	4
BF19	1	1	1	1	1	3	8	1	2	3	5	11	19	17	25	42	1082	15	21
BF20	1	1	2	1	1	3	3	1	1	4	5	5	14	22	50	72	512	55	15