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ABSTRACT

This paper reports a study in which eighteen structural and linguistic variables were identified, defined and used in an attempt to determine which variables accounted for a significant amount of the observed variance in the difficulty level of items on two different conditional reasoning tests administered to high school and college students. The use of regression analysis identified a tentative subset of variables which accounted for a significant amount of variance in the proportion of correct judgments of verbal simple deductive arguments of the conditional type. (PEB)

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STRUCTURAL AND LINGUISTIC VARIABLES THAT CONTRIBUTE TO DIFFICULTY IN THE JUDGMENT OF DEDUCTIVE ARGUMENTS OF THE CONDITIONAL TYPE*

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Structural and Linguistic Variables That Contribute to Difficulty in the Judgment of Deductive Arguments of the Conditional Type

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ABSTRACT

Eighteen structural and linguistic variables were identified, defined, and used in an attempt to determine which variables would account for a significant amount of the observed variance in the difficulty level of items on two different conditional reasoning tests administered to high school and college students. Using regression analysis involving these structural and linguistic variables, a tentative subset of variables was identified which accounts for a significant amount of the variance in the proportion of correct judgments of verbal simple deductive arguments of the conditional type.

STRUCTURAL AND LINGUISTIC VARIABLES THAT CONTRIBUTE TO DIFFICULTY IN THE JUDGMENT OF DEDUCTIVE ARGUMENTS OF THE CONDITIONAL TYPE

A number of recent studies by Jerman and others (e.g., Jerman and Rees, 1972; Jerman, 1973 a, b; Krushinski, 1973; Beardslee and Jerman, 1973; 1974; Cook, 1973, 1974) have focused on the influence of structural and linguistic variables on the relative difficulty of verbal and/or computational arithmetic and algebra problems. Jansson (1974) conducted an exploratory investigation in an attempt to identify those structural and linguistic variables which strongly influence the relative difficulty of subjects handling the judgment of simple deductive arguments in verbal form. The purposes of the present study were to refine and further investigate the variables explored in Jansson's study, identify and define in a clear and explicit way a set of new relevant structural and linguistic variables, determine which set of these variables would account for a significant amount of the observed variance in the proportion of correct judgments made by high school and college subjects on tests involving verbal simple deductive arguments of a conditional type of reasoning, and attempt to shed light on a possible way curriculum developers and teachers can control the relative difficulty of such deductive arguments when preparing instructional materials.

A simple deductive argument in the present investigation refers to a chain of reasoning involving three statements or propositions, where the first two propositions are premises (assumed to be true) and the third one is the conclusion drawn from the premises. If at least one of the premises is a conditional statement, then the argument is of the conditional type. Ennis and Paulus (1965), in the Cornell Critical Thinking Project, viewed the judgment of such arguments as a significant component of the broader concept of critical thinking, which in turn was defined in terms of the notion of the "correct assessing of statements."

A number of other researchers (e.g., Hill, 1961; O'Brien and Shapiro, 1968; Roberge and Paulus, 1971; O'Brien, Shapiro, and Reali, 1971; Roberge, 1969, 1970; Gardiner, 1965; Shipman, 1974; Tripp, 1974; Jansson, 1973; DiNapoli, 1974; Rizza, 1974), both within and outside the conceptual framework of Ennis and Paulus and the Cornell Critical Thinking Project, have studied the logical skills of subjects of a wide range of ages over such variables as type of logic reasoning (i.e., class and conditional), principle of reasoning (such as, modus ponens, contrapositive, converse, inverse, and transitivity), age, sex, content and context of arguments, negations in agruments, subject aptitude and their interactions. In an overall sense, the variables investigated in these studies dealt with structure of the problem itself) and learner aptitude-interaction characteristics with regard to correctly handling the judgment of simple deductive arguments in verbal form.

While the studies in this framework have shed some light on the nature of these structural and linguistic variables and learner characteristics, no clear evidence is yet available so that we can say to curriculum developers and teachers which of these variables and/or learner aptitude-interaction factors minimize the difficulty level in verbal simple deductive arguments.

Jansson (1974) made an initial attempt to employ a new approach--linear regression analysis techniques--to the study of structural and linguistic variables as predictors of the relative difficulty in verbal simple deductive arguments. Of course, this is not to imply that learner aptitude-interaction factors do not come into play, but until clear evidence is available concerning such factors, we believe that this new approach will prove to be a more significant avenue for research and curricular/instructional development. This regression approach has been used by Jerman and his associates in studies of structural and lingusitic variables as predictors of difficulty in the areas of verbal and computational problem solving in arithmetic and algebra. The approach in the present study was to employ linear regression techniques to identify those structural and linguistic variables that account for a significant amount of the observed variance in the proportion of correct judgments of verbal simple conditional arguments.

II. Method

The Linear Regression Model

The linear regression model employed in the present study is the same one specified and outlined in Jansson's (1974) study. In an attempt to be complete, the model and its notation and rationale are repeated here. Let the jth variable of problem i be denote by v_{ij}. The corresponding weight assigned to the jth variable is denoted by α_j. Let p_i be the observed proportion of correct responses on problem i for a given population sample. The purpose of the model is to predict P_i for each problem i, Thus, in terms of the variables v_{ij} and their associated weights α_j, the linear regression model is given by

$$p_i = \sum_j \alpha_j v_{ij} + \alpha_o \qquad (1)$$

Since the estimated weighting and values for the variables are combined to predict p_i, this model may not preserve probability. So in order to insure that the p_i's will always lie between 0 and 1, the usual practice has been to make the following logarithmic transformation and define a new variable z_i.

$$z_i = \log [(1-p_i)/p_i] \qquad (2)$$

Thus, the regression model becomes

$$z_i = \sum_j \alpha_j v_{ij} + \alpha_o. \qquad (3)$$

In the case where the observed p_i is either 0 or 1, we define z_i as follows:

$$z_i = \begin{cases} \log (2n_i - 1) & \text{for } p_i = 0 \\ \log [1/(2n_i - 1)] & \text{for } p_i = 1, \end{cases}$$

where n_i denotes the total number of subjects responding to problem i. According to Jerman and Rees (1972, p.307):

> "The reason for putting $1-p_i$ in the numerator of equation (2) is to make the variables z_i increase monotonically in difficulty. It is desirable that the model reflect an increase in difficulty level rather than inversely as the magnitude of the variables v_{ij} increases."

This model, together with the transformation as indicated above, were adhered to in the present study.

Definition of Variables

In the present study 18 structural and linguistic variables were used. Eleven of these variables, some of which were slightly refined by the writer, were originally developed in Jansson's (1974) study. The remaining seven variables were newly developed based on suggestions for further investigation made in Jansson's study, as well as implications made in studies by Roberge (1971), Shipman (1974), and Tripp (1974).

The variables used in the present investigation are defined as follows, with the newly developed variables beginning with variable 12.

X_1: Principles of Inference (PRINFR)

Coded: 1 for modus ponens; 2 for transitive; 3 for contrapositive; 4 for inverse; 5 for converse

X_2: Validity of the Argument (VALIDY)

Coded: 1 if valid; 2 if invalid; 3 if "can't tell"

X_3: Content type (CONTNT)

Coded: 1 for concrete-familiar; 2 for suggestive; 3 for abstract

X_4: Sentence length (SENTL)

Coded: One count for each word in the total argument.

X_5: Total number of words in premise 1 (WRDP1)

Coded: One count for each word in premise 1

X_6: Average word length (AWRDL)

Coded: Average word length in number of letters of the total argument. That is, the total number of letters in the argument, not counting punctuation, divided by the total number of words in the argument.

X_7: Ratio of number of words in premises (WP1P2)

Coded: Value of the ratio of the total number of words in premise 1 to the total number of words in premise 2.

X_8: Total number of negations in the argument (TOTNGS).

Coded: One count for each negation in the argument.

X_9: Number of negations in premise 1 (NEGP1).

Coded: One count for each negation in premise 1.

X_{10}: Number of negations in premise 2 (NEGP2)

Coded: One count for each negation in premise 2.

X_{11}: Number of negations in conclusion statement of the argument (NEGC).

Coded: One count for each negation in conclusion statement of the argument.

X_{12}: Total number of words in the conclusion statement of argument (WRDC)

Coded: One count for each word in the conclusion statement.

X_{13}: Average word length in premise 1 (AWRDLP1).

Coded: Average word length in number of letters of premise 1.

X_{14}: Average word length in premise 2 (AWRDLP2)

Coded: Average word length in number of letters of premise 2.

X_{15}: Average word length of antecedent in premise 1 (AWDLA).

Coded: Average word length in number of letters in antecedent of premise 1. That is, total number of letters in the antecedent divided by the total number of words in the antecedent.

X_{16}: Average word length of consequent in premise 1 (AWRDLC).

Coded: Average word length in number of letters in the consequent of premise 1.

X_{17}: Negation in the antecedent of premise 1 (NEGP1A)

Coded: 1 if negation exists; 0 if negation does not exist.

X_{18}: Negation in the consequent of premise 1 (NEGP1C)

Coded: 1 if negation exists; 0 if negation does not exist.

The Conditional Reasoning Tests

Two testing instruments, the Shipman-Tripp Conditional Reasoning Test (Form C123-4), a 23-item test which was developed and used in studies by Shipman (1974) and Tripp (1974), and the Shipman Conditional Reasoning Test (Form CFS-5), a 30-item test which was developed and validated for the present study, were used to gather data. Each of these tests stems from the work of Paulus (1967) and Roberge (1970) and the conceptual framwork of the Cornell Critical Thinking Project.

The items, or arguments, on each test are designed to evaluated subjects' abilities to judge the validity of selected principles of deductive reasoning of the conditional type in verbal form and in different content dimensions. Item format on each test is common as follows:

Suppose you know that
  Premise 1.
  Premise 2.
Then would this be true?
  Conclusion.

For each item, three responses were possible for indicating its validity status and were defined as follows:

1.	YES	It must be true.
2.	NO	It can't be true.
3.	MAYBE	It may be true or it may not be true. You were not told enough to be certain whether it is "YES" or "NO."

The Principles of Reasoning

In the present investigation, five basic principles of conditional reasoning were of interest. Each of these principles, along with its symbolic form, a sample verbal form and its validity status, is exhibited in Table 1. The Shipman test covers all of these principles, while the Shipman-Tripp test covers all except the modus ponens principle.

Insert Table 1 about here

The Content Dimension

In the literature (e.g. Wilkins, 1928; Tripp, 1974), the content dimension of logical arguments is divided in three segments: (1) concrete-familiar, (2) suggestive, and (3) abstract. Concrete-familiar items are those in which the conclusion of the argument possesses a neutral truth value with the vocabulary throughout the argument being familiar. If at least one statement in the argument contradicts common knowledge, then the argument is labeled suggestive. Samples of concrete-familiar items are given in Table 1. An example of a suggestive item is as follows:

If frogs can not hop, then cats can sing.
Cats can sing.
Therefore, frogs can not hop.

Both tests contain concrete-familiar and suggestive items, which were used in the present investigation.

The third segment of the content dimension involves abstract or nonverbal symbolism which was not considered a part of the present study.

III. Procedures

Each item on both tests was identified and quantified with respect to the 18 structural and linguistic variables. These sets of information formed the data base for the independent or predictor variables in the study.

The tests were administered at a predominately black university to 10th, 11th, and 12th grade Upward Bound students, freshman elementary education majors, and freshman general mathematics students with little or no formal training in logical thinking. The Shipman-Tripp test was administered to 115 subjects, of which 54 were Upward Bound students. The Shipman test was administered to 70 freshman general mathematics students. In the administration of each test, the examiner directed the students to complete each item. It was emphasized that the tests were not speed tests.

The data were subjected to linear regression techniques. Specifically, using a step-wise linear regression computer program, seperate linear regression analyses with a common logarithmic transformation as described earlier were applied to each of the following data sets:

1. Shipman-Tripp Conditional Reasoning Test - College subjects (S-T (C))
2. Shipman-Tripp Conditional Reasoning Test - High school subjects (S-T (H))
3. Shipman-Conditional Reasoning Test (SCRT).

A linear regression analysis was performed on a subset of each of these data sets. The computer program in each instance was designed to indicate what specific variables entered the regression model and in which order.

IV. Results

Summary data for the tests are presented in Table 2. In Table 3 the entry order of the 18 variables for each test together with multiple R values is given.

Insert Table 2 & 3 about here

A deatiled look at the results of the regression analyses is considered below with respect to each test.

1. Shipman-Tripp Conditional Reasoning Test

College subjects. The variables which entered and their entry order for this test over college subjects are displayed in the first column of Table 3. It is apparent that variable 2, VALIDY, entered first, and it accounted for a major portion of the observed variance (nearly 45 percent). A total of six steps in the regression analysis was needed to account for approximately 73% of the total variance in the observed probability correct. Variable 1, PRINFR, unexpectedly entered the regression at step 5.

In Table 4 the regression coefficients along with computed t-values at the junction where all entering variables have actually entered the regression are given. Notice that variable 5, NEGP1, was the only variable significantly different from zero and it entered the regression at step 4.

Insert Table 4 about here

High school subjects. In column three of Table 3 the VALIDY variable is shown to enter the regression analysis first for the Shipman-Tripp test over high school subjects. However, in this case, only 38 percent of the observed variance in the probability correct is accounted for. Two of the same variables, WRDP1 and PRINFR, which entered the S-T (C) regression also entered within the first six steps of the S-T (H) regression. The amount of total variance accounted for in the observed probability correct at step 6 was approximately 70 percent.

The regression coefficients with t-values calculated at the point where all entering variables have entered the regression are exhibited in column two of Table 4. None of the variables were significantly different from zero at a desirable level.

2. Shipman Conditional Reasoning Test

For this test the order of entry and corresponding R values of the variables are presented in column 6 and 7 of Table 3, while the regression coefficients and their t-values are presented in Table 5.

Insert Table 5 about here

In step 1 of the regression, variable 1, PRINFR, entered and accounted for more than 65 percent of the observed variance in the probability correct. The addition of more variables, 3, 14, 16, 18, and 15, increased R square to approximatily 84 percent. Variable 2, VALIDY, did not enter the regression until step 11. At the point where all variables entered only the PRINFR variable was statistically significant.

3. Results of Other Analyses on Tests

Using a selected subset of the original variables from each of the data sets, some further analyses were performed. In the case of the Shipman-Tripp test over each group of subjects, the variables which entered the original calculations in the first 10 steps were used as a subset. This was done because at step 10 the

R square value, in each instance, was approximately 81.5 percent. The resulting regression coefficients, t-values and entry orders of the variables appear in Table 6. For both calculations the VALIDY variable came in first and was statistically significant, while different variables involving the location of negations entered at step 2 as was true in the first calculations.

Insert Table 6 and 7 about here

For the Shipman test (Table 7) the variables which entered in the first five steps of the first calculation were selected for further investigation. The PRINFR variables remained as the major contributor to the variance accounted for (65 percent) in the regression. The addition of the other four variables increased the value of R square to more than 83 percent.

The correlation matrices for the data sets appear in Tables 8 and 9. Notice that for both test $r_{1,2}$ is fairly high in a positive direction. An obvious reason for this is the similiar nature of the definitions of the variables involved. Other similarities may be noted, but will not be discussed here.

Insert Tables 8 and 9 about here

A number of studies, including Jansson's (1974) study, have shown that the different principles of inference influence subjects' abilities to judge simple conditional arguments in verbal form. In the present study this finding is not completely substantiated. However, in an overall sense, the present study seems to indicate that the PRINFR variable is relatively strong in its contribution to the observed variance in the proportion of correct judgments.

Some of the other findings in the present study vary with those findings made in Jansson's (1974) study. This, of course, is to be expected since some of the newly defined variables nudged ahead of some of the original defined variables and perhaps a few different learner-aptitude interaction variables came into play. In spite of this, an inspection of R square values in the present investigation suggests that a few new important variables have been uncovered.

The present study suggests that the variables involving selected locations of negations in the argument, average word length in various parts of the argument, validity, and content may be important and deserve further study. Futher study must also be performed on several different subsets of the variables defined here. In addition, study should be conducted to examine performance over a range of age/grade levels on the tests used in this study.

In summary we can conclude that while the present study is important in that it approaches or points to a procedure for finding structural and linguistic variables which influence the relative difficulty of subjects handling the judgment of verbal simple deductive arguments of the conditional type via regression analysis methods, we are not yet in possession of satisfactory difficulty predictors, nor can we prescribe for the curriculum developer and teacher appropriate conditional logic exercises (arguments) for secondary school and college subjects. Yet, this study does move researchers a bit closer to finding stable difficulty predictors which can be used in constructing appropriate mathematics materials in the area of conditional logic.

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TABLE 1

Basic Principles of Conditional Reasoning

Principle	Valid	Symbolic form	Sample concrete verbal form
1 Modus Ponens	YES	If P, then Q. P. ∴, Q.	If the truck is a Ford, then it belongs to John. The truck is a Ford. ∴, the truck belongs to John.
2 Contrapositive	YES	If P, then Q Not Q. ∴, not P.	If the car is black, then it is a police car. The car is not a police car. ∴, the car is not black.
3 Converse	NO	If P, then Q. Q. ∴, P.	If the shirt is green, then I will wear it. I will wear the shirt. ∴, the shirt is green.
4 Inverse	NO	If P, then Q. Not P. ∴, not Q.	If the cat is grey, then his name is Shaft. The cat is not grey. ∴, the cat's name is not Shaft.
5 Transitivity	YES	If P, then Q. If Q, then R. ∴, if P, then R.	If it is Jim, then it is time to go. If it is time to go, then call me. ∴, if it is Jim, then call me.

TABLE 2

Summary of Test Results

Test	$\bar{X}$	σ	Number of Test Items	Number of Subjects
Shipman-Tripp (C)*	7.77	3.11	23	61
Shipman-Tripp (H)**	6.83	2.22	23	54
Shipman	12.80	4.19	30	70

*College subjects tested.
**High school subjects tested.

TABLE 3

Entry Order and Corresponding Multiple R Values for the Variables

Step	S-T (C)		S-T (H)		SCRT	
	Variable Entered	R	Variable Entered	R	Variable Entered	R
1	VALIDY	.662	VALIDY	.619	PRINFR	.810
2	NEGP1C	.691	NEGP2	.691	CONTNT	.846
3	WRDC	.739	PRINFR	.741	AWRDLP2	.869
4	WRDP1	.773	NEGC	.784	AWRDLC	.905
5	PRINFR	.810	AWRDLP1	.822	NEGP1C	.912
6	AWRDLA	.853	WRDP1	.834	AWRDLA	.916
7	NEGP1	.862	SENTL	.863	WP1/P2	.919
8	NEGC	.883	WP1/P2	.884	WRDC	.924
9	SENTL	.887	WRDC	.889	NEGP2	.928
10	WP1/P2	.904	AWRDLC	.905	NEGC	.935
11	AWRDLP2	.926	AWRDLA	.911	VALIDY	.939
12	AWRDLC	.930	CONTNT	.915	AWRDLP1	.944
13	AWRDLP1	.953	AWRDLP2	.919	AWRDL	.945
14	NEGP2	.958	AWRDL	.926	WRDP1	.946
15	AWRDL	.960	NEGP1A	.943	SENTL	.947
16	CONTNT	.963	TOTNGS	.944	NEGP1A	.947
17	TOTNGS	.963	NEGP1C	.944	TOTNGS	.949

TABLE 4

Regression Coefficients, Standard Errors of Regression Coeffients, and computed t-values

Variable		S-T (C)			S-T (H)		
No.	Name	Coeff.	S.E.	t	Coeff.	S.E.	t
1	PRINFR	.325	.162	2.001[c]	.266	.149	1.784[c]
2	VALIDY	.142	.204	.695	.133	.188	.708
3	CONTNT	.121	.182	.666	.185	.167	1.106
4	SENTL	.109	.086	1.266	.037	.079	.462
5	WRDP1	-.292	.109	-2.669[b]	-.146	.101	-1.446
12	WRDC	-.025	.136	-.186	.018	.125	.145
6	AWRDL	.108	.155	.693	.132	.143	.924
13	AWRDLP1	1.521	.948	1.604	.995	.873	1.139
14	AWRDLP2	.031	.185	.167	.189	.171	1.107
15	AWRDLA	-.792	.686	-1.154	-.826	.632	-1.308
16	AWRDLC	-1.250	.728	-1.716	-.992	.671	-1.479
7	WP1/P2	.359	.504	.710	-.037	.465	-.079
8	TOTNGS	.107	.429	.250	-.075	.395	-.189
9	NEGP1	.269	.411	.653	—	—	—
10	NEGP2	.052	.496	.104	.303	.457	-.663
11	NEGC	-.297	.428	-.695	.105	.394	.265
17	NEGP1A	—	—	—	.304	.379	.803
18	NEGP1C	-.643	.324	-1.988	.035	.485	.073

$^{a}p < .01$ $^{b}p < .05$ $^{c}p < .1$

TABLE 5

Regression Coefficients, Standard Errors of Regression Coefficients, and Computed t-Values

Shipman Test

No.	Variable Name	Coeff.	S.E.	t
1	PRINFR	.271	.072	3.789[a]
2	VALIDY	.095	.105	.907
3	CONTNT	.373	.195	1.916
4	SENTL	.027	.054	.511
5	WRDP1	-.057	.081	-.704
6	WRDC	.015	.086	.180
7	AWRDL	.369	.480	.769
8	AWRDLP1	-1.536	1.320	-1.164
9	AWRDLP2	-.258	.114	-2.261[b]
10	AWRDLA	.653	.560	1.168
11	AWRDLC	.849	.572	1.485
12	WP1/P2	.259	.145	1.786
13	TOTNGS	-.217	.292	-.746
14	NEGP1			
15	NEGP2	.417	.312	1.338
16	NEGC	.010	.309	.034
17	NEGP1A	.220	.288	.766
18	NEGP1C	.205	.303	.676

$^{a}p < .01$ $^{b}p < .05$

TABLE 6

Regression Coefficients, Standard Errors of Regression Coefficients and computed t-values

		S-T (C)				S-T (H)			
	Variable	Coeff	S.E	t	Entry Order	Coeff	S.E.	t	Entry Order
1	PRINFR	.354	1.222	2.893[b]	5	.292	.083	3.521[a]	3
2	VALIDY	.043	.150	.285	1	.017	.098	.171	1
4	SENTL	.080	.050	1.580	9	.101	.043	2.358[b]	7
5	WRDP1	-.178	.071	-2.500[b]	4	-.199	.070	-2.844[b]	6
6	WRDC	.014	.072	.201	3	-.095	.065	-1.449	9
8	AWRDLP1					.020	.206	.096	5
10	AWRDLA	-.055	.147	-.377	6				
11	AWRDLC					-.256	.187	-1.364	10
12	WP1/P2	.400	.279	1.421	10	.420	.193	2.172	8
14	NEGP1	.084	.148	.571	7				
15	NEGP2					.338	.153	2.206	2
16	NEGC	-.207	.129	-1.614	8	.125	.128	.975	4
18	NEGP1C	-.265	.202	-1.317	2				

[a] $p < .01$ [b] $p < .05$

TABLE 7

Regression Coefficients, Standard Errors of Regression Coefficients and Computed t-Values

Shipman Test

Variable		Coeff	S.E.	t	Entry Order
1	PRINFR	.249	.027	9.073[a]	1
3	CONTNT	.193	.081	2.393	2
14	AWRDLP1	-.287	.077	-3.746	3
16	AWRDLC	.348	.113	3.078	4
18	NEGP1C	-.115	.082	-1.407	5

[a] $P < .01$

TABLE 8

Correlation Matrix of 18 Variables: Shipman-Tripp Test (C) & (H)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.00	.83	-.10	-.62	-.09	-.69	.18	-.22	.25	.08	-.30	.67	-.58	-.16	-.66	-.22	-.06	-.17
2		1.00	-.21	-.43	-.00	-.49	.08	-.29	.16	-.06	-.31	.67	-.43	.02	-.52	-.32	-.13	.15
3			1.00	.22	-.49	-.11	.15	.58	.21	.37	.52	-.12	.12	-.03	.07	.25	.02	-.05
4				1.00	.69	.93	.00	.13	-.17	.20	-.03	-.68	.55	.15	.48	.32	-.02	.23
5					1.00	.48	.03	-.21	-.16	.21	-.50	-.12	.22	.27	-.09	.13	.16	.23
6						1.00	-.13	.20	-.16	.19	.06	-.62	.64	.18	.51	.45	.03	.23
7							1.00	.36	.07	.27	.29	-.21	.11	.07	.17	-.08	-.20	.29
8								1.00	.53	.60	.81	-.31	.51	.23	.30	.37	.18	.16
9									1.00	.43	.41	.18	.06	.06	-.13	.16	.14	-.05
10										1.00	.06	-.19	.14	.03	-.20	.51	.07	-.02
11											1.00	-.27	.50	.21	.51	.08	.16	.15
12												1.00	-.30	.27	-.70	-.16	.37	.03
13													1.00	.74	.52	.35	.47	.59
14														1.00	.06	.04	.72	.72
15															1.00	-.22	-.28	.36
16																1.00	.29	-.23
17																	1.00	.04
18																		1.00

TABLE 9

Correlation Matrix of 18 Variables: Shipman Test

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.00	.74	.00	-.31	-.07	-.41	-.03	.01	.15	-.01	.02	.09	-.21	-.28	-.14	-.05	-.05	-.35
2		1.00	.00	-.22	-.00	-.29	-.17	-.15	.00	-.33	.05	.14	-.10	-.15	-.16	.01	-.22	.68
3			1.00	-.65	-.71	-.43	.66	.60	.38	.42	.44	.08	-.03	-.15	-.20	.26	-.07	-.14
4				1.00	.59	.86	-.46	-.40	-.32	-.24	-.29	-.57	.22	.25	.28	-.02	.15	.19
5					1.00	.16	-.47	-.53	-.33	-.41	-.39	.10	.16	.41	.18	-.22	.27	.29
6						1.00	-.31	-.21	-.19	-.12	-.09	-.58	.14	.02	.17	.15	.01	.02
7							1.00	.96	.76	.73	.70	.11	-.23	-.25	-.22	-.04	-.34	-.00
8								1.00	.76	.76	.77	.04	-.28	-.37	-.19	-.05	-.46	-.04
9									1.00	.40	.76	.10	-.38	-.29	-.37	-.17	-.39	-.01
10										1.00	.20	-.10	-.08	-.34	.11	.08	-.33	-.14
11											1.00	.12	-.40	-.29	-.42	-.15	-.42	.02
12												1.00	-.14	.02	-.34	-.01	.01	.02
13													1.00	.73	.67	.67	.56	.45
14														1.00	.25	.21	.71	.67
15															1.00	.26	.20	.14
16																1.00	.19	.09
17																	1.00	-.05
18																		1.00