

# Developments in Business Simulation & Experiential Exercises, Volume 8, 1981

## THE IMPLICATIONS OF COGNITIVE PROCESSING VARIABLES AND THE COMPLEX DECISION

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### ABSTRACT

This study explored quality differences in complex decisions by variations of a number of cognitive processing variables. The complex problem was generated through the use of a management game with success measured in terms of game performance. The variables and performance are explained using a multivariate regression model.

### INTRODUCTION

Individuals appear to differ in the amount and types of information to which they orient in a complex decision making situation. Factors which may be responsible for these differences are the relative complexity of cognitive structure--that is, the number and kind of constructs available and habitually utilized; the type or temperament of the individual; and the degree to which uncertainty is perceived as threatening.

This study is designed to explore quality differences in complex decisions by variations in cognitive structure, type, tolerance of ambiguity and grade point averages among decision makers. The complex problems are generated through the use of a management game with success measured in terms of game performance. The cognitive processing variables and game performance are explained using a multivariate regression model.

### METHODOLOGY

#### Cognitive Structure

Differences in cognitive structure among decision-makers has been described in terms of their relative ability to differentiate among dimensions of a complex problem and to discriminate by interpreting differences within a dimension. These abilities were measured by Bieri's Cognitive Complexity-Simplicity Test (1) and Pettigrew's Category Width Scale (2).

- A. Cognitive Complexity-Simplicity Test (C-C)--Cognitive complexity is defined by Bieri as the capacity to construe social behavior in a multidimensional way. A more cognitively complex person is assumed to have a more differentiated system of dimensions available than does a cognitively simple person. The Cognitive Complexity-Simplicity Test (C-C) is based on the contention that an individual with more dimensions in his cognitive structure will make more distinct interpretations than an individual with fewer dimensions.
- B. Category Width Scale (C-W)--Category width is defined as the ability to discriminate, or to recognize differences among elements classified along the same dimensions. Pettigrew's C-W scale measures how broadly an individual is tuned to the environment. Wide categorizers cast large data nets while narrow categorizers cast small nets.

#### Type Indicator

Dimensions of individual style or types were measured using the Myers-Briggs type indicator (3). The type indicator or "temperament sorter test provides three pairs of preferences for the individual tested: extravert vs. introvert (E-I), intuitive vs. sensitive (I-S), and feeling vs. thinking (F-T).

#### Tolerance of Ambiguity

Budner (4) define intolerance of ambiguity as the tendency to perceive ambiguous situations as sources of threat, and tolerance as the tendency to perceive them as desirable. A high ambiguity tolerance is viewed as a willingness to accept a state of affairs capable of alternate interpretations, or of alternate outcomes. Low ambiguity tolerance is shown by the desire to have everything reduced to black and white. This construct was measured by McDonald's AT-20 (5).

#### Grade Point Average

The subjects grade point average (GPA) as four year college students were drawn and used as an additional variable.

#### The Complex Problem

Relationships between cognitive structure, tolerance of ambiguity type indicators, and GPA were examined by testing individuals faced with complex decision-making tasks. The complex tasks were generated through use of a business game. Business College seniors (n=32) in a Business Policy class at the University of Hawaii played eight simulated quarters of Edge, Keys and Remus' The Multinational Management Game (6) from initially equal starting positions. Each subject performed one of two complex tasks. These tasks were:

##### Task No. 1 - Division Manager

Each participant (three per team) was required to make periodic decisions regarding product price, promotion expenditures, production schedule, etc. for a specific division (Japan, West Germany or USA).

##### Task No. 2 - Corporate President

Each participant (one per team) was required to make periodic decisions regarding the financial well being and competitive position of the multinational corporation.

Because of the game Structure there were significant differences in ROI for the three countries. The CEO's ROI was the average of the team ROI. These country and CEO mean ROI's were as follows: Japan -15.58, USA 12.23, West Germany 92.13, and CEO=29.59.

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## RESULTS

For this analysis four regression models are presented and discussed.

Model 1 is the full model including all tests, CPA, and the country variable represented by three indicator variables. Since there were definite country differences, this variable was included in all later models. Three tests were not significant in the full model and were dropped from the model one at a time using a backwards regression program.

Model 2 shows some significance (at least at the .10 level)

MODEL 1

$R^2 = .832$   $f = 10.39$   $P = .01$

VARIABLE	REGRESSION COEFFICIENT	BETA	P
Constant	38.58		
Country 1	71.27	0.67	.01
Country 2	-40.47	-0.38	.01
Country 3	-5.02	-0.05	ns
C-C	-0.14	-0.15	.10
C-W	0.14	0.06	ns
E-I	2.16	0.11	ns
I-S	-0.17	-0.01	ns
F-T	-3.74	-0.14	.10
AT-20	-3.64	-0.26	.05
GPA	15.65	0.17	.05

for each of the variables remaining in the model. Country 3 was not significant but was one of the indicator variables so remains in the model. The Beta values indicate the change in ROI (in standard deviations) for a standard deviation increase in the predictor variable. The AT-20 test shows the strongest relationship, followed by CPA, and then C-C and F-T.

Model 3 and Model 4 differ in that only one of C-U or F-T

MODEL 2

$R^2 = .823$   $f = 15.91$   $P = .01$

VARIABLE	REGRESSION COEFFICIENT	BETA	P
Constant	50.82		
Country 1	67.16	0.63	.01
Country 2	-42.85	-0.40	.01
Country 3	-7.23	-0.07	ns
C-C	-0.14	-0.15	.10
F-T	-4.02	-0.15	.10
AT-20	-3.16	-0.23	.05
GPA	16.86	0.18	.05

were included in the model. The correlation between the two was  $r = .39$ , the highest simple correlation among the predictor variables. When this is done each becomes significant at the .05 level. There is very little difference in explanatory powers of Models 3 and 4.

The results of the test and measures that proved significant are discussed individually hereafter.

MODEL 3

$R^2 = .809$   $f = 17.3$   $P = .01$

VARIABLE	REGRESSION COEFFICIENT	BETA	P
Constant	35.55		
Country 1	67.98	.64	.01
Country 2	-38.86	-0.36	.01
Country 3	-1.13	-0.01	ns
C-C	-0.18	-0.19	.05
AT-20	-2.81	-0.20	.05
GPA	15.70	.17	.05

MODEL 4

$R^2 = .806$   $f = 17.3$   $P = .01$

VARIABLE	REGRESSION COEFFICIENT	BETA	P
Constant	31.89		
Country 1	70.94	0.67	.01
Country 2	-39.64	-0.37	.01
Country 3	-2.48	-0.02	ns
F-T	-5.23	-0.20	.05
AT-20	-2.98	-0.21	.05
GPA	15.50	0.17	.05

### The Tolerance of Ambiguity Test (AT-20)

This test is an indication of a subject's willingness to accept a state of affairs capable of alternative interpretation or of alternative outcome. Model 2 indicates by the negative regression coefficient of -3.16 that the lower a person scored on the test the higher the expected ROI would be. Specifically for every one point of increase in ambiguity tolerance ROI would drop 3.16 percent. In order to assess the relative affect of the several variables on ROI, Beta values are given. The Beta coefficient is the standardized regression coefficient and does not depend on the unit of measurement of the independent variables. Beta represents the change (in standard deviation) of ROI for a 1 standard deviation increase in the independent variable. The highest Beta of all the tests and measures was the AT-20 varying from -.2 to -.26 depending on the model used.

### Grade Point Average

It is interesting to observe that CPA is not as strong an indicator of success as the AT-20 test as evidenced by its Beta value of .18 compared to AT-20's -.23. The CPA does provide a positive indication (coefficient of 16.86) that the higher it is, the higher the ROI score will be.

### Cognitive Complexity-Simplicity Test

The more cognitively complex person is assumed to have a more differentiated system of dimensions than does his counterpart. This measure reflects an *inverse* relationship between cognitive complexity and the score obtained which explains the negative regression coefficient of -.14 given in Model 2. Therefore the more cognitively complex an individual is, the higher the expected ROI score.

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### Type Indicator Test

The "type indicator or 'temperament sorter'" test provided three pairs of preferences for the individual tested: extravert vs. introvert, Sensitive vs. intuitive, and feeling vs. thinking. The results of the first two pairs provided insignificant information. The results of the later, the feeling vs. thinking produced significant results in Model 4 with a negative regression coefficient of  $-5.23$  which indicates that the "thinking type" is more likely to score higher on ROI than his counterpart.

### SUMMARY

Interpreting the models it can be observed that the person most likely to score high in ROI in the management game is one who likes his decisions reduced to black and white, is cognitively complex rather than simple, is a thinking rather than feeling type person and has a relatively high GPA. These findings seem entirely consistent considering that the complex problem faced by these subjects is to a high degree quantitative rather than qualitative, rational rather than emotion and logical rather than illogical.

### REFERENCES

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