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GROUP COGNITIVE STYLE AND COMPUTERPHOBIA IN FUNCTIONAL BUSINESS SIMULATIONS

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ABSTRACT

Performance in a business simulation was examined in relation to trait anxiety, computer anxiety and cognitive style, determined at the group level of analysis. Groups were classified as high/low trait anxiety, high/ low on three dimensions of computer anxiety, and sensing/intuitive and thinking/feeling cognitive style. Results indicated that there was a significant relationship between trait anxiety and group performance and a significant relationship between thinking/feeling groups and group performance.

INTRODUCTION

Since the first business simulation game was used in a college class at the University of Washington in 1957 (Watson, 1981), the number and variety of business games available for classroom use has grown enormously (Whiteley & Faria, 1989). Based on a recent survey entailing approximately 1,500 mail and telephone contacts, Faria (1987) estimated that over 200 business games are currently being used by approximately 8,755 instructors in over 1,900 four-year business schools.

Research related to the use of computer simulations in the classroom has also increased greatly. This research has generally focused on identifying environmental, individual and group variables, which affect performance, as well as the relative educational benefits of simulation games versus other teaching approaches.

Individual variables which have been examined include personality characteristics of the simulation team members (Patz, 1989), ethnic origin of team members (Faria, 1986), previous business experience (Trinka, 1981), selected analytical skills (Hall, 1987), and Grade point averages and aptitude scores (McKenney & Dill, 1966; Gray, 1972).

One of the main weaknesses of much of this work is that the most common outcome variable is team performance, a group variable which is examined in light of individual variables. In a recent review of management games used in education and research, Keys & Wolfe (1990) suggest that rather than examining individual variables as predictors of group performance, a more useful analysis would be to examine the dominant thinking and decision making style that prevails on a given team. Because management games and actual management decision making are group experiences and groups must work together to achieve optimal learning and success, it is essential that we understand the group variables which affect performance. Three such group composition factors were examined in this study, general or trait anxiety, computer anxiety and cognitive style. Each of these factors was examined at the group level by creating composite scores for each group.

Computer Anxiety

As students are required to use computers, it has become evident that not all students are comfortable in doing so. Many students' experience varying degrees of anxiety when required to use or even learn about computers. Jay (1981) has referred to these negative reactions as Computerphobia". Loyd and Gressard (1984, p. 67) define computer anxiety as "resistance to thinking about computer technology, fear of computers, and hostile or aggressive thoughts about computers".

It has also been suggested in the literature that anxiety toward a subject area such as mathematics (Fennema & Sherman, 1976) may influence the learning process. Therefore, it seems likely that student's attitude toward computers and toward simulations, which involve computers, may be an important factor in their success or failure on computer-based management simulation games.

Trait Anxiety

While computer anxiety can be traced to situations in which computers are encountered, trait anxiety is viewed as anxiety which occurs in a wide variety of situations not necessarily related to situations involving computers. Taylor (1953, p. 285) defines trait, or general anxiety as a relatively constant level of internal anxiety or emotionality".

Individuals who score high on trait or general anxiety tend to perceive the environment as threatening and uncontrollable and are less able than those who score low on general anxiety to control autonomic reactions to stress situations. In stressful situations, high scorers tend to feel anxious, tense, and jumpy and are likely to experience some physiological changes, such as excessive perspiration, increased pulse rate, and greater emotional discomfort (Dahlstrom, Welsh, & Dahlstrom, 1975).

Because the literature does not make a clear distinction between general and situational anxiety, both trait and computer anxiety were addressed in this study. In both cases, it is hypothesized that anxiety will be negatively related to performance. Support has been found in the past for this relationship (Sarason, Mandler & Craighill, 1952; Alpert & Haber, 1960).

Therefore, the following hypotheses are suggested:

- H₁: Performance in the simulation will be negatively related to computer anxiety.
- H₂: Performance in the simulation will be positively related to computer liking.
- H₃: Performance in the simulation will be positively related to computer confidence.
- H₄: Performance in the simulation will be negatively related to trait anxiety.

Cognitive Style

One of the aspects of personality that would logically be relevant to group task behavior is that of cognitive style. Cognitive style refers to the way in which one goes about organizing and processing information to complete a decision task. Conceptually, cognitive style has been defined as "the way in which people process and organize information and arrive at judgments or conclusions based on their observations of situations" (Steers, 1988). These styles are viewed as relatively stable dispositions which lead to differences in behavior in the decision making process. These dispositions and the characteristic processing presumed to underlie them are referred to as cognitive "styles" to indicate that this stability extends over a variety of tasks with similar task demands and/or stimulus properties (Shipman & Shipman, 1985).

Historically, there have been numerous operationalizations of cognitive style. These include such unidimensional measurements as "ways of reasoning" termed analytic versus heuristic (Huysman, 1970), information processing capacity" measured as abstract versus concrete (Schroeder & Suedfeld, 1971), and ability to separate an object from its environment (Witkin, 1967).

A number of researchers have developed multi-dimensional measures of cognitive style, including Driver and Mock (1975), who examined cognitive style in terms of the number of solutions generated and the amount of information used, McKeeney and Keen (1974) who operationalized cognitive style in terms of information gathering and information evaluation, and Mason and Mitroff (1973) who examined cognitive style based on the Jungian dimensions of sensing/intuition and thinking/feeling (Jung, 1970) These two dimensions relate to types of information processing and decision making. In later work, Mitroff

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(1983) identified four distinct cognitive styles as ST (sensing/thinking), SF (sensing/feeling), NT (intuitive/thinking), and NF (intuitive/feeling).

Sensing (S) refers to perception of the immediate experience, an awareness of what is occurring in the present, and a concern for details. Sensing individuals prefer structured problems, which involve routines and details. Intuition (N) refers to perception of possibilities, going beyond what is immediately present in the situation, and an appreciation of the overall meaning of a situation. Intuitives prefer unstructured problems.

Thinking (T) refers to the use of logic and objective analysis, and tends to be impersonal, and feeling (F) refers to an emphasis on individual and group values and subjective impressions, and tends to be personal.

Recently, researchers have begun to examine the concept of cognitive style as it relates to simulations used in the classroom setting (Paw 1989; Henderson & Null, 1980). Grove, Stephen & Knowles (1990) used the MBTI to examine cost performance in a computer simulated business environment. These authors found a significant difference in cost performance for different cognitive styles. They hypothesized that ST's would perform best, followed by NT, SF, and NF styles. The results of their study indicated that overall, S's performed more efficiently than N's.

Patz (1989) created team personality types based on the MBTI dimensions of sensing/intuition and thinking/feeling and found that intuitive/ thinking (NT) teams established and maintained an early lead in a total enterprise simulation.

One possible explanation for these differing results may lie in the type of tasks required in the simulations. In the simulation used by Groves et al (1990) the tasks may have been relatively well defined, requiring attention to detail as preferred by sensing individuals, while the tasks in the total enterprise simulation used by Patz (1989) may have been unstructured tasks, requiring intuitive capabilities. Given these mixed results, it is clear that further research concerning the relationship between cognitive style and simulation performance is necessary.

The *Brands* simulation used in this study involved largely unstructured problem solving, and required logic and objective analysis. The *Brands* simulation has a reputation for modeling very extensive marketing research capabilities. Therefore, it was reasoned that similar to the results of Patz's study, intuitives would perform the task better than sensing groups, and thinking groups would perform better than feeling groups. The following hypotheses are proposed:

- H₅: Performance in the simulation will be better for intuitive groups than for sensing groups.
- H₆: Performance in the simulation will be better for thinking groups than for feeling groups.

METHOD

Sample

Subjects were 70 undergraduate students enrolled in two sections of an undergraduate marketing strategy course and one section of a marketing policy course at two eastern universities. In all classes, participation in a simulation game named *Brands: A Marketing Simulation* (Chapman, 1992) constituted 40 % of the students' grades.

Dependent Measure

Overall team performance was measured by a weighted composite score based on return on investment, operating efficiency, and change in market share.

Independent Measures

Cognitive Style. The MBTI is a tool, which was developed by Myers (1962) as an operationalization of Jung's psychological theory. The MBTI measures personality on four dimensions (introvert/extrovert, sensing/intuition, thinking/feeling, and perception/judgment). Although the complete form was administered, only two dimensions, sensing/ intuition and thinking/feeling were used in the analysis. Support for the use of only two dimensions (sensing/intuition and thinking/feeling) as a measure of cognitive style can be found in the work of Mason & Mitroff (1973) and Ruble & Cosier (1990). Reliability and validity issues are discussed in detail by Carlyn (1977) and by Carlson (1985).

Computer Anxiety. Although it was believed that computer anxiety would have a direct affect on simulation performance, it was not clear whether measures of computer anxiety reflect only computer anxiety, or might also reflect general anxiety. Therefore, a scale was administered which included twenty questions which measure general anxiety (Manifest Anxiety Scale: Taylor, 1953) and twenty-five questions which measure computer anxiety (Computer Anxiety Scale: Loyd & Gressard, 1984).

The Computer Anxiety Scale (CAS) developed by Loyd and Gressard (1984) contains three subscales: fear and anxiety about computers (computer anxiety), enjoyment in working with computers (computer liking), and confidence in the ability to use and to learn about computers (computer confidence). The instrument contains thirty Likert-type items and six-point ordered response scales that are anchored by the terms, "Strongly Agree" and "Strongly Disagree". Fifteen of the items are content reversed.

In their original study, Loyd and Gressard (1984) reported that the reliabilities were .86, .91, .91, and .95 for the computer anxiety, computer liking, and computer confidence subscales, and the total score, respectively.

General Anxiety. Taylor (1953) developed a measure of trait anxiety based on the Minnesota Multiphase Personality Inventory. The MAS was originally comprised of fifty items but was later reduced to a twenty-item scale by Bendig (1956). This twenty-item scale was found to be as reliable as the original scale. The reliability scales were .78 (50-item scale) and .76 (20-item scale) with intercorrelations among the scores of .93 and .91. Because the twenty-item scale was more parsimonious of testing time, it was utilized in this study.

Procedure

The authors of this article administered the MBTI, CAS and MAS in classroom settings, along with a questionnaire, which provided demographic data.

Brands is a marketing simulation designed for use in a senior-level capstone course. For the simulation, teams were formed during the third week of the semester. The teams were formed randomly. Twenty-one student teams, composed of four to five students, undertook marketing research to ascertain consumer preferences, and manufactured two products, which were sold in three geographic markets. Decisions were made concerning product characteristics, price, sales force size and compensation, advertising and sales promotion and product distribution.

The game horizon included twelve decision periods with each decision period representing one quarter (three months) of business activity. The major objectives of each team were to maximize profits and to manage an efficient organization. Each game lasted approximately three months in real time, with each decision or iteration made at one-week intervals for a total of twelve decisions. After each decision, participants received detailed balance sheets, profit and loss statements, operating analysis and market data.

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RESULTS

The data analysis proceeded in three phases: 1) the factor analyses of the anxiety items, 2) classification of student groups according to group cognitive style and anxiety level, and 3) hypotheses testing.

Factor Analyses

Three factor analyses were performed, one with all 45 anxiety items, one with just the computer anxiety items and one with only the trait anxiety items.

The objective of the first factor analysis was to examine the structure of the 45 anxiety items in terms of computer anxiety versus general anxiety. The question addressed by this analysis was whether or not computer anxiety and general anxiety are two distinct constructs. A principal components analysis, with a varimax rotation, was employed. Eleven factors had eigenvalues over 1.0. The scree plot indicated a three-factor solution. An examination of the item loadings, however, showed that all 25 computer anxiety items loaded solely on the first factor while no trait anxiety items loaded on factor one except for one which loaded on both factor one and factor two. This was regarded as strong evidence that the computer anxiety items and trait anxiety items were from separate domains.

The second factor analysis was a principal components analysis of the 25 computer anxiety items. Four factors had eigenvalues greater than 1.0 and the scree plot suggested two factors. Two-, three- and four-factor solutions with varimax rotations were examined. The three-factor solution closely approximated results of others (Lloyd and Gressard, 1984) and accounted for 17% of the variance (See Table 1). The three factors were interpreted to represent *computer anxiety*, *computer liking*, and *computer confidence*. This interpretation is more consistent with Lloyd and Gressard than that of Bandalos and Benson (1990).

The third principal components analysis was performed on the 20 trait anxiety items. Six factors had eigenvalues over 1.0. The scree plot suggested a two-factor solution. Examination of two-, three-, and four-factor varimax-rotated solutions, however, showed unstable item loadings. A number of items loaded on two factors and others switched from factor to factor as the solution dimensionality was increased. Most convincingly, an examination of item contents defied interpretation.

TABLE 1
FACTOR ANALYSIS OF COMPUTER ANXIETY ITEMS

		Factor 1 Anxiety	Factor 2 Liking	Factor 3 Confidence
2	I get a sinking feeling when trying to use a computer.	0.85		
24	Computers usually make me feel nervous and uncomfortable.	0.70		-0.40
34	I am no good with computers.	0.58		-0.51
14	I'm not the type to do well with computers.	0.56		-0.53
3	I do not think I could handle a computer course.	0.55	-0.39	-0.39
9	I would feel comfortable working with a computer.	-0.53		0.52
29	It would not bother me at all to take a computer course.	-0.58	0.44	0.45
18	I have lots of self confidence when it comes to working with computers.	-0.60		
23	Generally, I would feel ok about trying a new problem on a computer.	-0.64	0.47	0.47
25	I would feel at ease in a computer class.	-0.66	0.42	0.42
37	Once I start working on the computer, I find it hard to stop.		0.75	0.75

		Factor 1 Anxiety	Factor 2 Liking	Factor 3 Confidence
41	I would like working with computers.	-0.44	0.70	0.70
35	I think working with computers would be enjoyable and stimulating.	-0.49	0.67	0.67
32	I'm sure I could do advanced work in computers.		0.57	
6	I do not enjoy talking with others about computers.		-0.53	-0.44
43	I will do as little work with computers as possible.	0.42	-0.53	
44	The challenge of solving problems with computers does not appeal to me.	0.45	-0.60	
8	Figuring out computer problems does not appeal to me.	0.45	-0.64	
13	I do not understand how some people can spend so much time working with computers and seem to enjoy it.		-0.70	
27	I am sure I could learn a computer language.			0.74
39	I am sure I could do work with computers.		0.40	0.71
40	I could get good grades in a computer course.		0.48	0.69
11	Computers do not scare me at all.	-0.44		0.67
30	I do not feel threatened when others talk about computers.			0.63
16	I think using a computer would be very hard for me.	0.50	-0.40	-0.56

Therefore, it was concluded that, in conformity with the literature (no published factor analyses of this scale), these items were best treated as a multi-item index of a single dimension. Scores for the 20 items were summed (reverse-scored items were subtracted) to yield a trait anxiety index for each of the 70 subjects. Scores ranged from 1 to 54, with a mean of 25.7. Cronbach's Coefficient Alpha for this scale was 0.52.

Classification of Groups

Each of the 21 student groups was classified as characterized by one end or the other of six dichotomous dimensions: two cognitive style dimensions, sensing/intuition (S/N) and thinking/feeling (T/F); and four anxiety dimensions: 'hi' versus 'lo' computer anxiety, computer liking, computer confidence, and trait anxiety.

Cognitive Style Grouping. Three different methods were derived or modified from the literature to suggest groupings. Method One was to classify each group as *sensing* or *intuitive* and as *thinking* or *feeling* according to the simple majority of team members' raw MBTI scores. Method Two was similar to the first, except that only students whose raw MBTI scores were distinctly greater than zero were used. The 23 highest (one-third of our sample) MBTI scores in each dimension were allowed to retain their cognitive style designations, and the remaining ones were grouped into middle, 'on-the-fence' groups. A simple majority was then used to categorize the group's cognitive style. In Method Three each of the two cognitive style pairs was treated as a bipolar dimension. Team members' raw MBTI measures for opposing styles were simply netted together. Teams were then categorized according to the direction of their total scores. The results of these grouping methods for the *sensing/intuition* style is illustrated in Table 2.

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TABLE 2
CLASSIFICATION OF GROUPS AS SENSING/INTUITION

		Method One Simple Majority		Method Two Majority, Excluding Middle- of-the-Roaders			Method Three Summed Raw Score	
Group	Style	S	N	S	M	N	S	N
1	N	1	2*	1	1	1		2.3
2	N	1	1	0	2	0		4.0
3	N	2	3*	2	1	2		0.2
4	N	2	2	2	0	2		0.5
S	N	1	2*	1	0	2*		14.3
6	S	2	2	*1	3	0	7.5	
7	S	*3	0	*2	1	0	17.7	
8	S	*2	1	*2	1	0	11.7	
9	N	2	2	1	1	2*		6.5
10	N	1	1	0	1	1*		60
11	S	1	1	1	0	1	5.0	
12	S	*2	1	*1	2	0	10.3	
13	S	*4	0	*1	3	0	13.5	
14	S	*3	2	2	1	2	34	
15	N	0	3*	0	0	3*		17.0
16	S	*2	1	*1	2	0	7.0	
17	S	*3	0	*2	1	0	14.3	
18	N	0	4*	0	1	3*		16.0
19	N	2	2	2	0	2		3.0
20	N	*2	1	0	2	1*		2.3
21	S	*2	0	*1	2	0	117	

As Table 2 shows, there was almost total consistency among the different methods of categorizing groups* cognitive styles. In all, there were only two cases of contradictory groupings, one each for sensing/ intuition (S/N) and thinking/feeling (T/F). In both cases Method One deviated from the other two. In one case two team members with marginal raw MBTI scores for sensing comprised a majority against the third team member's substantial *intuition* rating. Method One thus classified the team sensing whereas Methods Two and Three classified the team *intuitive*. In the other case a similar discrepancy occurred for a *thinking* versus *feeling* classification. In both instances, the groups were classified according to Methods Two and Three.

Anxiety Grouping. Essentially the same three methods were used for categorizing groups according to *computer anxiety*, *computer liking*, *computer confidence*, and *trait anxiety*. Groups were characterized as either *hi* or *lo* on each of these dimensions. As was the case for cognitive style, conflicting grouping was not a problem, only one conflict occurred. Once again, Method One results conflicted with Methods Two and Three and the group was classified according to Methods Two and Three.

Hypothesis Testing

The dependent variable in all the hypotheses was a group performance measure automatically assessed by the *Brands* simulation. Scores for the 21 teams ranged from 80 to 93 and averaged 86.

Computer Anxiety Hypotheses. Using simple t-tests none of the three hypotheses for *computer anxiety*, *computer liking*, and *computer confidence* were supported by the data

Trait Anxiety Hypothesis. Hypothesis Four stated that performance should be negatively related to trait anxiety. *Hi* trait anxiety groups scored an average performance rating of 83.7 while *lo* trait anxiety groups averaged 88.5. This is a significant difference. The t-statistics was 2.99 ($p < 0.005$)

Cognitive Style Hypotheses. For Hypotheses Five and Six, it was hypothesized that intuitive groups would score higher than sensing

Groups and thinking groups would score higher than feeling groups. This was tested using an unbalanced 2x2 factorial ANOVA. Table 3.

TABLE 3
COGNITIVE STYLE ANALYSIS OF VARIANCE

With Interaction Term:

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Sensing/ Intuition	1	17.5	17.5	1.07	0.31
Thinking/Feeling	1	61.5	61.5	3.76	.007
SN X TF	1	16.3	16.3	1.00	0.33
Error	17	277.7			
Corrected Total	20	372.0			

R-Square: 0.25

Without Interaction Term:

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Sensing/ Intuition	1	16.1	16.1	0.99	0.33
Thinking/Feeling	1	58.9	58.9	3.61	0.07
Error	18	294.0			
Corrected Total	20	372.0			

0.21

Cell Means:

	Sensing	Intuition	Total
Thinking	82.4	86.0 (n=5)	84.2 (n=5)
Felling	87.2	87.7 (n=5)	87.6 (n=6)
Total	85.0	86.9	86.0

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As indicated in the table, neither the sensing/intuition-by-thinking/ feeling interaction nor the sensing/intuition main effects were significant. Thinking/feeling did show a moderately significant main effect. Examining group means reveals, however, that the thinking/feeling effect occurred in the direction opposite to that hypothesized. Feeling groups performed better than thinking groups, with feeling groups averaging 87.6 to thinking groups 84.2.

TABLE 4
THINKING/FEELING AND TRAIT ANXIETY
ANALYSIS OF VARIANCE

With Interaction Term:					
Source	DF	Squares	Sum of Square	Mean F Value	Pr > F
Thinking/Feeling	1	41.0	41.0	3.30	0.09
Trait Anxiety	1	95.9	95.9	7.72	0.01
TF x TA	1	1.3	1.3	0.10	0.75
Error	17	211.2			
Corrected Total	20	372.0			
R-Square:	0.43				
Without Interaction Term:					
Source	DF	Square	Sum of Square	Mean F Value	Pr > F
Thinking/Feeling	1	40.2	40.2	3.41	.009
Trait Anxiety	1	97.7	97.7	8.28	.001
Error	18	212.4			
Corrected Total	20	372.0			
R-Square:	0.43				
Cell Means:					
	Thinking	Feeling	Total		
Low Trait Anxiety	86.5	89.8 (n=4)	88.5 (n=6)		
High Trait Anxiety	82.7	85.0 (n=6)	83.7 (n=5)		
Total	85.0	86.9	86.0		

A final ANOVA was used to investigate the possibility of an interaction between thinking/feeling and trait anxiety. As Table 4 shows, there was no interaction.

DISCUSSION AND CONCLUSIONS

The research question addressed in this study was whether business simulation performance was related to general anxiety, computer anxiety and/or cognitive style. The findings indicated that computer anxiety is a multi-dimensional construct composed of computer anxiety, computer liking and computer confidence, and that trait anxiety is best represented as a single dimension. This finding is consistent with previous work (Lloyd & Gressard, 1984; Taylor, 1953).

The results also indicate that the three methods utilized in previous research for categorizing groups according to individual MBTI scores produce similar groupings.

Although the hypotheses concerning computer anxiety were not supported, this may have been due to the role that computers played in this particular simulation. Computers were only used for inputting decisions and were not an integral part of the simulation experience. Future research is needed to determine the role of computer anxiety in simulations where computer interaction is central.

As hypothesized, performance was negatively related to trait anxiety and therefore, instructors who use simulations in the classroom should be sensitive to the effects of students' trait anxiety.

The results of the group cognitive style on simulation performance were counterintuitive. The relationship between feeling groups and group performance was surprising. It may be explained by the nature of the game and the spirit of the class. The lack of results for sensing versus intuitive groups is less easily explained. It was hypothesized that intuitive groups would perform better than sensing groups. The results did not bear this out. The intuitive groups may have been experimenters while sensing groups may have been more cautious in their strategies.

Limitations of the Study

A main limitation of this study was the sample size. A sample of seventy is only marginally sufficient for three factor analyses of 45 items. A larger sample may have led to a stable solution for the trait anxiety items. In the case of the ANOVA's, twenty-one teams were used in the analysis. A larger sample would have allowed us to increase the number of levels per factor, or perhaps include an anxiety component in the ANOVA as either a distinct factor or as a covariate.

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