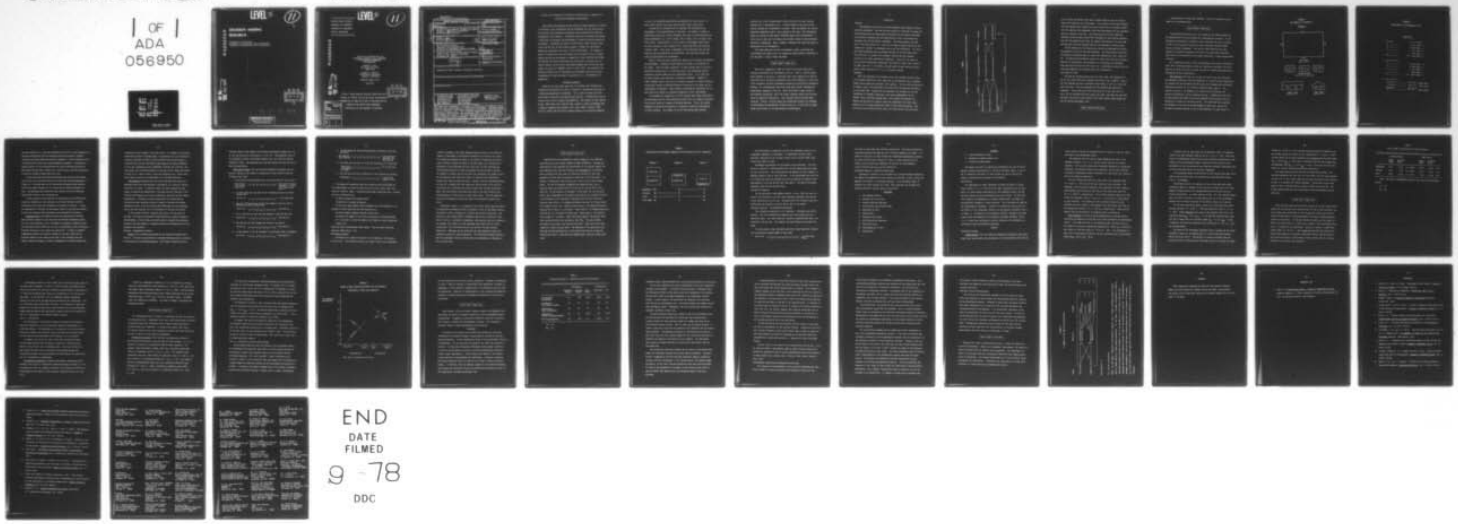
AD-A056 950 WASHINGTON UNIV SEATTLE DEPT OF PSYCHOLOGY F/G 5/1
THE ROLE OF ENVIRONMENTAL AND BEHAVIORAL UNCERTAINTY AS A MODER--ETC(U)
JUN 78 S E WEED, T R MITCHELL N00014-76-C-0193
UNCLASSIFIED TR-78-15 NL

| OF |
ADA
056950



END
DATE
FILMED
9-78
DDC

LEVEL II

(11)

DECISION MAKING RESEARCH

DEPARTMENT OF PSYCHOLOGY
DEPARTMENT OF MANAGEMENT AND ORGANIZATION
UNIVERSITY OF WASHINGTON, SEATTLE, WASHINGTON

LEVEL II

11

DECISION MAKING RESEARCH
DEPARTMENT OF PSYCHOLOGY
UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON

AD A056950

THE ROLE OF ENVIRONMENTAL AND[1] BEHAVIORAL UNCERTAINTY AS A MODERATOR OF SITUATIONAL-PERFORMANCE RELATIONSHIPS

Stanley E. Weed
Utah State University
Logan, Utah

Terence R. Mitchell
University of Washington
Seattle, Washington

Technical Report 78-15

June 1978

Office of Naval Research Contract N00014-76-C-0193
(Terence R. Mitchell and Lee Roy Beach, Investigators)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: TR-78-15 (14)	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER (9)	
4. TITLE (and Subtitle): The Role of Environmental and Behavioral Uncertainty as a Moderator of Situational-Performance Relationships (6)	5. TYPE OF REPORT & PERIOD COVERED: Technical Report (13)
6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s): Stanley E. Weed, Terence R. Mitchell (10)	8. CONTRACT OR GRANT NUMBER(s): N00014-76-C-0193 (15)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Decision Making Research, Department of Psychology NI-25, University of Washington, Seattle, WA 98195	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS (11)
11. CONTROLLING OFFICE NAME AND ADDRESS: Organizational Effectiveness Research Programs, Office of Naval Research (Code 452), Arlington, VA 22217	12. REPORT DATE: June 1978
	13. NUMBER OF PAGES: 40
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (12) 42p.	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

AD3C 945

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Structuring Leader	Environmental Uncertainty	Leadership Style
Considerate Leader	Behavioral Uncertainty	Moderator-Criterion Relationships
Structured Task	Job Satisfaction	
Unstructured Task	Job Performance	
Goal Condition	Task Structure	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The causes and consequences of two types of uncertainty (environmental and behavioral) were investigated in a simulated job environment. Employees worked with a structuring or considerate leader, on a structured or unstructured task and with or without a goal. The structuring leader and structured task produced greater certainty than the considerate leader or the unstructured task. Goal setting had no effect. The same independent variables and increased certainty resulted in higher performance. The implications of the results are discussed for theories of uncertainty and organizational performance.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE S/N 0102-LF-014-6601

387783

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The Role of Environmental and Behavioral Uncertainty as a Moderator of Situational-Performance Relationships[1]

Some of the most important factors which have been suggested to influence an individual's job satisfaction and job performance are the uncertainties one has about the surrounding environment and the uncertainties about the consequences of his behavior. Uncertainty about the surrounding environment is described as unpleasant and detrimental to effective decision making and performance. MacCrimmon and Taylor's (1976) recent review discusses these issues and the ways in which people attempt to reduce this uncertainty. Behavioral uncertainty also seems to limit effectiveness. For example, a number of studies have shown that people with an internal locus of control (people who see the environment as responsive to their actions) have higher satisfaction and better performance than those with an external locus of control (people who see little relationship between their actions and what happens to them (e.g., Mitchell, Smyser & Weed, 1975). The purpose of the following research was to investigate more thoroughly the causes and the consequences of these two types of uncertainty (i.e., environmental and behavioral).

BACKGROUND RESEARCH

There are at least three major sets of variables that influence performance and satisfaction for which a reduction in uncertainty may serve as a mediating psychological explanation. First, there are those variables which might be described as organizational policies. Included here would be factors such as goals, targets and objectives. The research on goal setting (Locke, 1968) shows that a specific goal results in better performance than a vague or ambiguous goal (Latham & Yukl, 1975; Steers & Porter, 1974). While no studies have explicitly examined measures of uncertainty reduction

as one of the mediating psychological explanations for these results, it seems fairly obvious that clear, specific goals reduce uncertainty.

A second set of variables that is important for satisfaction and performance is the characteristics of the task. For example, a number of studies have shown that a highly ambiguous task leads to dissatisfaction and lower performance (e.g., Brief & Aldag, 1976, Szilagyi, Sims & Keller, 1976; Miles, 1976). Other theories, such as Fiedler's Contingency Model define low task structure as less favorable for a leader than high task structure (Fiedler, 1967). Thus, there is agreement in the literature that low task structure may cause ambiguity and uncertainty, and that these factors may limit job satisfaction and performance.

Finally, there are some interpersonal factors that influence satisfaction and performance. Probably the most important of these is the behavior of the leader. Given the major dichotomy of a task oriented style or an interpersonally oriented style, it would seem that a task orientation affects uncertainty variables more than an interpersonal style. It is clear that the task oriented style positively influences performance. Stogdill's (1974) handbook reports that out of 25 studies reviewed, 20 showed a positive relationship between structuring behavior on the part of the leader and the subordinates' performance. Again, however, psychological uncertainty has not been explicitly studied as a potential moderator of this relationship.

In reviewing the research on all of the factors that affect satisfaction and performance and for which uncertainty might serve as a moderating explanation we were struck by a number of research omissions. First, few studies attempted to ascertain the additive or interactive effects of combinations of these variables. For example, we do not know whether goal setting

combined with a task oriented style is more effective than goal setting combined with a considerate style. A second problem is that most of the studies reviewed are correlational in nature. Very few studies, for example, manipulate leadership style or the structure of the task. This methodology limits our ability to make causal inferences about these relationships. A third issue is that very few studies have actually looked at the uncertainty variables as moderators. What is needed is research that shows the causes of uncertainty and its consequences.

With these omissions in mind, we developed a model to describe the relationships that might exist, and designed an organizational simulation to test the model. Figure 1 shows the model.

Insert Figure 1 about here

What we are suggesting is that all three of the input factors will influence satisfaction and performance (link #1). That is, specific goals (when compared to no goals), a structured task (when compared to an unstructured task) and a structuring leadership style (when compared to a style with little structure) increase performance primarily and satisfaction secondarily. Moreover, it is hypothesized that these three input factors influence our psychological moderators (link #2). Goals should have a major effect on environmental uncertainty, while the leader's behavior should have its main effect on behavioral uncertainty. Task structure should influence both variables. Finally, we would expect the uncertainty variables to influence the performance and satisfaction criteria (link #3). A high level of uncertainty should result in low satisfaction and performance.

METHODOLOGY

Subjects

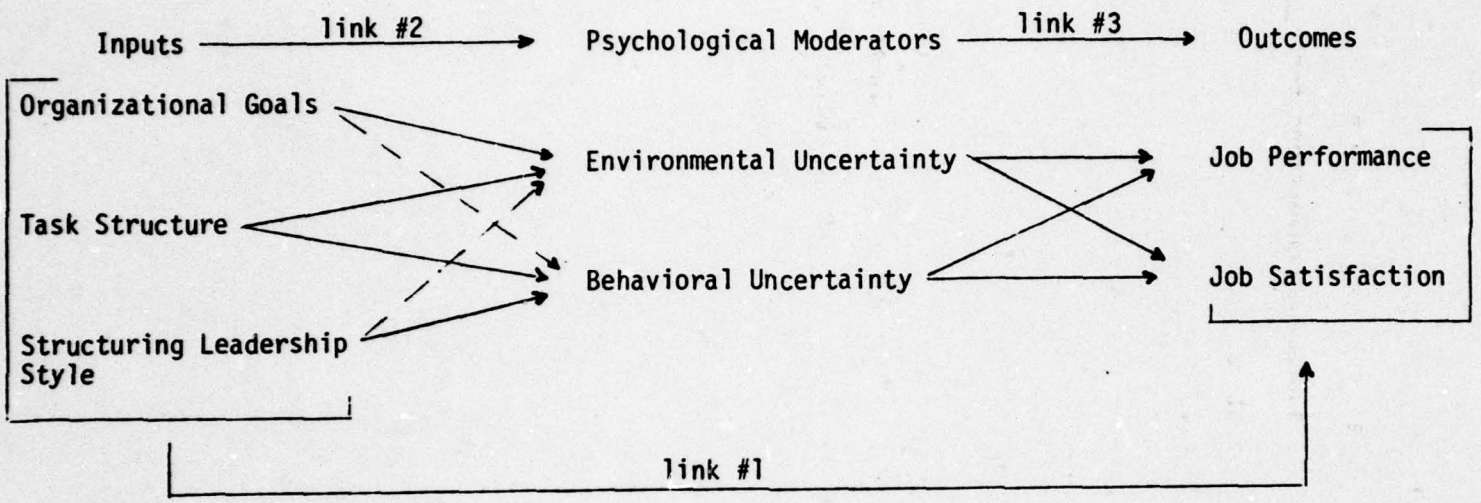
The employees were solicited through newspaper advertisements offering part-time employment. The work involved looking at blueprints of houses and making calculations and measurement conversions for raw material estimates. A preliminary screening test was administered in order to eliminate the extremely high and low ability candidates. The ability measure was also used in the data analysis as a covariate in order to adjust within-cell and between-cell variance in performance due to ability differences. In addition, only those candidates who were between the ages of 18 and 25 were hired. From that pool, 64 subjects were randomly selected and then randomly assigned to the eight experimental conditions. There were two levels of task structure (ambiguous, structured), two levels of leader style (high IS - low CONS, and low IS - high CONS), and two levels of goal setting (no goal, specific goal) resulting in a 2 x 2 x 2 factorial design.

Procedure

After the employees were screened, hired, and assigned to their respective treatment conditions, their supervisor (a confederate) made a telephone contact and arranged the employees' work schedule. The work setting consisted of tables, chairs, and partitions with no more than two employees working at any one given time. Although the two employees were assigned to the same combination of treatment conditions, they worked independently of one another, with a partition between them. This allowed the employees to observe and perceive the leader's style and interaction with other subordinates as well as experiencing the impact of that style personally. Each work session was divided into two parts, the first being a learning period

FIGURE 1

A Model of the Causes and Consequences of Psychological Uncertainty



(LP) in which the subjects were able to become familiar with the task and master the operations and calculations. Pilot testing of the task indicated that the average worker required two and one-half hours to acquaint himself with the materials and procedures, after which performance was less dependent upon his learning of the task. The second phase of the work condition, hereafter called the goal period (GP) introduced the goal-setting treatment. Here half the subjects were given the general instruction of "do your best" and the other half were assigned specific and moderately difficult goals.

At the completion of the second work session the employees were given a questionnaire as part of the work assignment. The questionnaire asked them to respond to conditions about the work, the organization, their supervisor, etc. Included were manipulation checks for leader style and task structure, measures of satisfaction, and perceptions of uncertainty and expectancy. They were paid $2.50 per hour for their work. Debriefings occurred after all sixty-four employees had completed their work assignments.

Description of Tasks

The task was designed specifically for this study, and consisted of a set of five simple blue print drawings (see Figure 2 for a sample). Each of the five drawings had three alternative floor plans, as well as a side view and an end view. The work assignment for the drawings had three basic components: (a) to draw one of the floor plans on to the "top view" to scale, (b) to calculate the floor space, wall space, and total for each room and house, and (c) to convert those to full scale (square feet) values and then to foreign measurement units.

Insert Figure 2 about here

Each drawing had a work sheet attached. Figure 3 illustrates the work sheet for the ambiguous task.

Insert Figure 3 about here

The description given was that "the blueprints are simple designs for the construction of low cost housing for underdeveloped countries. We are attempting to determine if advisors in those countries who have no training or skill in this area will be able to read, understand, and help people utilize the given information. Your work on these blueprints and your response to questions afterwards will enable us to make better decisions about how to design blueprints and present information in these underdeveloped countries."

As an additional source of help, the employees were given an information sheet which contained conversions from (a) fractions to decimals, (b) scale measures to square feet and (c) inches and feet to foreign measurement units.

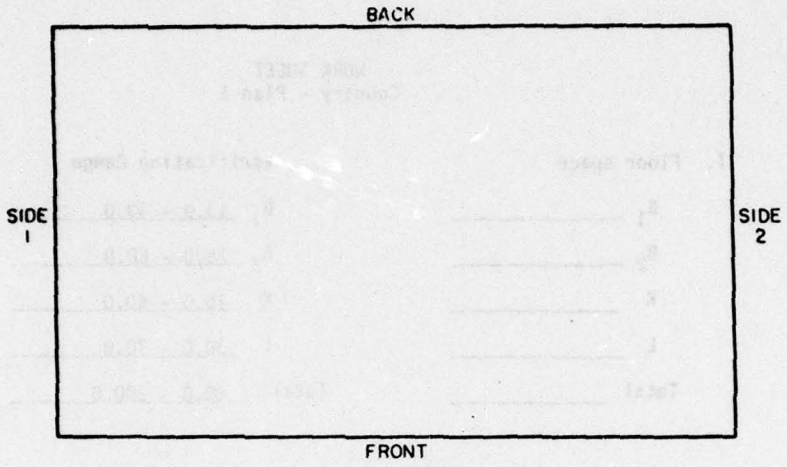
Independent Variable Manipulations

Task Structure--The same set of plans was used in both the structured and ambiguous conditions, with the differences in structure being accomplished by providing (or not providing) specific cues that correspond with previously established criteria for the structure dimension (Shaw, Note 1). The specific cues were: (a) feedback, (b) multiplicity of solutions, (c) solution verifiability, and (d) direction clarity. Feedback was built into the work sheets (see Figure 3) and varied between the two tasks as to how frequently it occurred in the work process. The structured task condition had feedback at each step in the performance of their task, whereas the ambiguous condition received it only at the completion of major blocks in

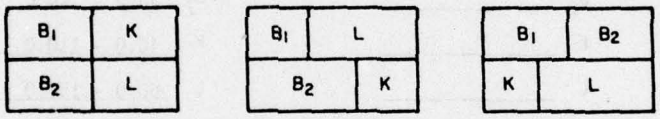
FIGURE 2

An Example of a Blueprint

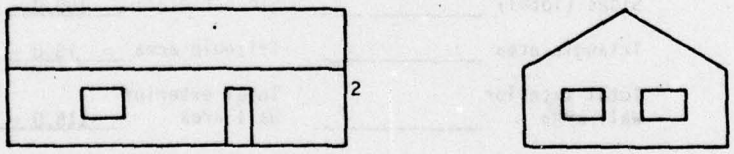
PLAN 1



TOP VIEW
SCALE: 1/8" = 1'-0"



FLOOR PLANS
SCALE: 1/4 OF TOP VIEW SCALE



FRONT VIEW
SCALE: 1/16" = 1'-0"

SIDE VIEW
SCALE: 1/16" = 1'-0"

FIGURE 3

Work Sheet for the Ambiguous Task

WORK SHEET
Country - Plan 1

		Verification Range
I. Floor space		
B_1	_____	B_1 13.0 - 30.0
B_2	_____	B_2 25.0 - 60.0
K	_____	K 15.0 - 40.0
L	_____	L 30.0 - 70.0
Total	_____	Total 80.0 - 200.0
II. Interior Wall Space		
B_1	_____	B_1 30.0 - 90.0
B_2	_____	B_2 50.0 - 140.0
K	_____	K 40.0 - 110.0
L	_____	L 60.0 - 150.0
Total	_____	Total 200.0 - 500.0
III. Exterior Wall Area		
Sides (Total)	_____	Sides (Total) 100.0 - 250.0
Triangle area	_____	Triangle area 15.0 - 35.0
Total exterior Wall area	_____	Total exterior Wall area 115.0 - 280.0

the task process (i.e., after the completion of five or six task computations). Solution verifiability for the structured task was provided at frequent intervals and within narrow and specific parameters. For the ambiguous tasks, verifiability was within very broad and general parameters. Direction and product clarity for the structured task was cued by defining specifically what should be done first, second, etc., and by giving a definite description of what the finished product would look like.

In the structured task condition employees were also told which house plan to start on, which floor plan to use, and which foreign measurement to convert to. A step-by-step set of instructions accompanied each drawing, and the work sheet allowed for a filling-in of the blanks throughout the task. The ambiguous task allowed for many options and let the employees choose where to start, how to proceed, etc.

A major purpose of this study was to provide tasks that differed with respect to ambiguity but were constant on all other dimensions and had performance scores that were comparable for purposes of analysis. A check for homogeneity of variance for performance scores on each task was conducted and this test supported the performance score comparability intention.

Leadership Style--The leadership style was manipulated by training three different leaders to each role-play two different leadership styles: (a) high on consideration, low on initiation of structure, hereafter called the considerate leader (CONS) and (b) low on consideration, high on structure, hereafter described as the structuring leader (IS). In order to maintain independence between the structure inherent in the task itself and the structure imposed by the leader on the task, it was necessary that the leader's behavior generate a climate or atmosphere of structure rather than

creating any actual changes in the task itself. For example, the condition consisting of specific assigned goals, a structured task, and initiation of structure leadership differed from the condition with specific goals, a structured task and the considerate leader only on the leader dimension. In this way, confounding of the independent variables was minimized. For this reason, the IS and CONS behavior on the part of the leader was limited to where to sit, when to start, a push for production, etc. Each of the three leaders served in the same number of IS and CONS conditions.

Goal Setting--Pretesting with the task established that nearly all employees could learn the procedure, computations, etc. during a learning period of 2 1/2 hours. In addition, about 35% could complete the same number of drawings and computations in the goal period as they had in the learning period plus one and one-half additional drawings (and the related computations). Therefore, the goal manipulation was accomplished by assigning the goal condition subjects a number of drawings and related computations equal to the first phase (LP) performance plus an additional one and one-half drawings, all to be completed in the goal period (GP).

In the no-goal condition, subjects were told to "do your best" on the task. This goal was presented without mention of a specific degree of accomplishment. Order effects were controlled by assigning the structured condition the same sequence of drawings selected by a matched person in the ambiguous task condition.

Measures: Methodological Checks

Ability--This variable was measured by the Wonderlic Personnel Test (Form V). The test was used both as a screening technique and as a covariate in the analysis of covariance procedure. Test-retest reliabilities with

different forms of the Wonderlic have yielded correlations ranging from .82 to .99, and split-half correlations of .88 to .94. With education level as the criterion, validity coefficients ranging from .95 to .99 are reported (Wonderlic, 1970). The employees were told that taking this test was part of their job application.

Manipulation Checks--The task structure-ambiguity conditions were compared by looking at the subjects' perceptions of task structure using the following scale items:

1. How clear and understandable were the instructions for your tasks?

   Very unclear. I was unsure what to do. /1/2/3/4/5/6/7/8/ Very clear and understandable. I could tell exactly what to do.

2. To what extent were you able to tell immediately what to do first, second, etc.?

   Not at all. /1/2/3/4/5/6/7/8/ A very great deal.

3. Was the finished product of this task something that was clearly definable and easily identified?

   Not at all. /1/2/3/4/5/6/7/8/ Very much so.

4. Was it possible to reach this end product in more than one way?

   Not at all. /1/2/3/4/5/6/7/8/ Very much so.

5. Was the task one that changed and varied to any extent?

   Not at all. /1/2/3/4/5/6/7/8/ Very much so.

6. To what extent is the job arranged in a particular order or sequence?

   Not at all. /1/2/3/4/5/6/7/8/ Very much so.

7. To what degree are there several possible solutions to the task problems?

Only one correct solution.	/	1	2	3	4	5	6	7	8	Many solutions available for the same job.

8. How often were you able to verify the correctness of a solution?

Never able to determine for sure.	/	1	2	3	4	5	6	7	8	All of the time.

9. How soon were you able to determine if your solution was correct?

Immediately.	/	1	2	3	4	5	6	7	8	A very great length of time.

The measure of leadership style was a modified form of the LBDQ XII. This modification was based on some previous analysis (Brown, 1967; Weed, Mitchell & Moffitt, 1975). Five-point Likert-type scales were used. Examples from the IS dimension are:

He needles members for greater effort.

He pushes for increased production.

He asks that group members follow standard rules and regulations, etc.

Examples of those items from the CONS dimension are:

He allows members complete freedom in their work.

He permits the members to use their own judgment in solving problems.

He is reluctant to allow the members any freedom of action (negatively scored), etc.

There were seven consideration items (alpha = .80) and eight initiating structure items (alpha = .92).

Performance Measures

Performance was scored on the basis of (a) completion, (b) accuracy, and (c) error. The completion measure was simply a tally of all completed

numerical responses, with those responses being weighted by the difficulty (number of operations or calculations required) of arriving at the answer. This weighting procedure was based on the number of operations and calculations required to obtain an answer on the work sheet, and disallowed any advantage to those employees who would skip over the more laborious and time-consuming portions in order to complete the less difficult portions. For example, an answer that was arrived at by converting from inches to feet for two measures (the length and width of a room) and then multiplying length times width was worth one point. However, one that required obtaining the area of a triangle (the roof slopes and ceiling joists on an end wall [see Figure 1]), converting that area to square feet and then converting it again into square meters and adding that area to the other exterior wall area obtained in a similar way was worth three points. The item completion values were estimated by taking the number of calculations (three versus nine).

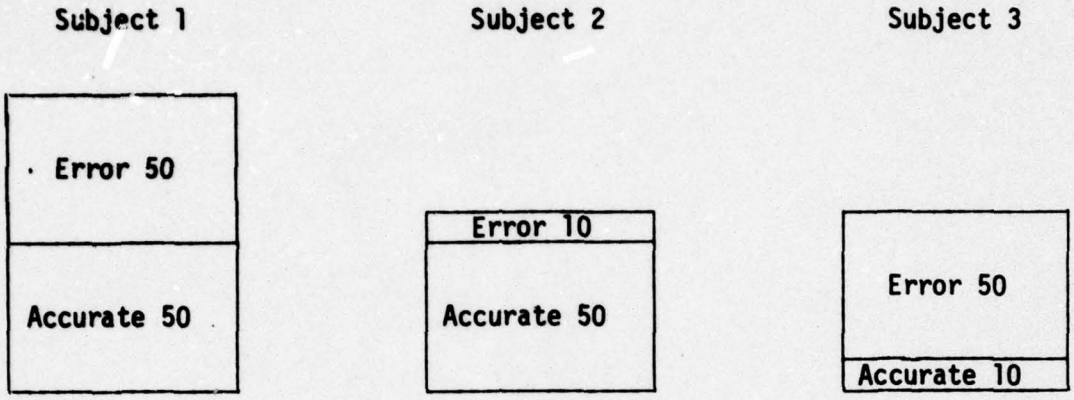
Completion, however, is a function of two things, those being the number of computations completed correctly (accuracy) as well as the number completed incorrectly (error), analogous to a quality and quantity distinction. Completion by itself masks certain information that would be available if one were to look at, in addition to completion, both accuracy and error separately. For example, (see Figure 4), three employees might score 100, 60, and 60 (completion), with individuals one and two getting different accuracy proportions. Employees two and three have the same completion scores but different accuracy and error proportions. This distinction becomes important when the independent variable contributions to performance are examined, as will be noted later.

Insert Figure 4 about here

Completion then was determined by simply summing all the completed operations on the work sheets weighted by their difficulty. Accuracy was determined by first examining the distribution of all possible answers for each completed item, and then assigning some percentage of the possible points available for that item (its difficulty weight) for each item depending upon how close the employee's answer was to the true score. For example, a three-point item may have had a "true" score of 196.5 square meters. For the 35 employees attempting and completing that item, a range of scores was obtained with 181.5 on the low end and 233.8 on the high end. The distribution of employees' scores about the true score was normal, and a percentage of the possible three points was assigned according to the distance of the individual's obtained score from the true score. Those who were within $\pm$ .25 standard deviations received 100% (three points) for accuracy on that item. Those who were within $\pm$ .50 standard deviations received 75% of three, or 2.25 points. Those within $\pm$ .75 standard deviations received 50%, or 1.50 points for that item. Those within $\pm$ 1.00 received 25% of three, or .75 points. Those with scores beyond 1.00 standard deviations received 0 points for accuracy on that item. The same standard deviation cut-off points were used for each item. These scores were then summed for a total accuracy score. The remainder of the completion score that had not been accounted for in the accuracy portion for an item was labeled error score. These were then summed across items for a total error score.

FIGURE 4

Partitioning of Performance Completion into Accuracy and Error Components



Completion	100	60	60
Accuracy	50	50	10
Error	50	10	50
Error Rate	.50	.17	.83

The partitioning of completion into the two components results in two independent components of completion. An independent variable could, therefore, contribute to the variance in goal period accuracy (GPA), goal period error (GPE), or both.

Performance was measured for two phases of the experiment. The first phase was labeled the learning period (LP), and the second phase was termed the goal period (GP). The learning period was designed to allow subjects an adequate amount of time to learn the task. It was anticipated (and confirmed in a pilot test) that the learning curve for the majority of subjects would have peaked in a two and one-half hour time period. The goal period began, therefore, after two and one-half hours.

Satisfaction Measures

The Job Descriptive Index (Smith, Kendall & Hulin, 1969) was used as a measure of satisfaction, with only those subscales relating to the job and to the supervisor being utilized. Corrected split-half internal consistency coefficients are reported to exceed .80 for each of the scales.

Perceptual Measures: Environmental Uncertainty

This variable was measured on two dimensions: information and predictability. The first dimension was measured with three items, each on a nine-point scale. The item content was related to organizational goals, the supervisor, and the task. For example, the item related to the supervisor reads:

"To what extent is the information provided by your supervisor adequate for the successful accomplishment of your work?"

Not at all. /__/__/__/__/__/__/__/__/__/ To a very great extent.
1 2 3 4 5 6 7 8 9

The task and goal items were similarly constructed. The three predictability questions were asked the same way and a six-scale composite was formed. The option of using all six items without the information-predictability portion was used since the factor analysis of those six items produced only one factor, and the coefficient alpha was .83 for the six-item composite. A sum of the six scores was used to reflect EU.

Perceptual Measures: Behavioral Uncertainty

Expectancy is defined in the literature as a behavior-outcome probability. The higher the probability the more certain an individual is that a particular behavior will result in a particular outcome. In the following study, 11 behaviors and three outcomes were used. These behaviors and outcomes were generated from past research and are listed below:

BEHAVIORS

1. Just getting started,
2. Knowing what to do first,
3. Getting along with the boss,
4. Getting along with my work group,
5. Organizing my work,
6. Seeking help,
7. Putting in extra time,
8. Utilizing outside resources,
9. Planning my work,
10. Just keeping at it, and
11. Working hard.

OUTCOMES

a. A good performance rating,

b. Acceptance by fellow workers, and

c. A sense of accomplishment.

The subject was asked to indicate the probability for each of the 33 behavior-outcome relationships on a 100-point calibrated scale. A sum of the 11 probability estimates for each outcome was used to reflect the subject's expectancy that outcomes follow behavior.

Data Analysis

The combination of three independent variables resulted in a three factor design--2 x 2 x 2, with the first factor representing the two task types, the second factor representing the two leadership styles, and the two goal-setting conditions representing the third factor. The data were first examined for homogeneity of variance between tasks, and there was nonsignificant divergence in these variances. This eliminated the need for any transformation procedures. Analysis of variance was used to test for the effects of the independent variables on the dependent variables (link #1 in Figure 1). Examination of the moderator variables included a two-stage process where the moderators were treated as dependent variables in the 2 x 2 x 2 model just mentioned and then as predictors of performance and satisfaction using correlational procedures.

RESULTS

Manipulation Checks

Leader Behavior--The two leadership dimensions exhibited by the confederates were tested against the perceptions of the subordinates with whom the

leaders worked by using the modified version of Stogdill's LBDQ XII (1963) described in the methodology section.

The composite scale for each of these dimensions was used as the dependent variable in a 2 x 2 x 2 design with an analysis of variance procedure. Since we were treating the leadership dimensions as independent constructs, two separate analyses were conducted, one for each dimension. A successful manipulation would be evidenced by a main-effect for leaders on both of the measured dimensions.

For the IS dimension there was a main effect for leadership style ($F = 53.66$, $p < .001$) but not for goal setting or task structure. The employees in the structured leadership style condition saw their leader as significantly more structuring than those in the considerate condition ($\bar{X} = 31.7$ and 17.7, respectively). For the CONS dimension there was a main effect for leadership style ($F = 32.83$, $p < .01$) but not for goal setting or task structure. The employees in the structured leadership style condition saw their leader as significantly less considerate than those in the considerate condition ($\bar{X} = 8.8$ and 14.9, respectively). These results suggest that the manipulation of leadership style was effective.

Task Structure--The task structure manipulation was checked against subordinate perceptions by using the scale items discussed in the methodology section. Nine items were used in the composite scale, and the results of the analysis of variance supported the manipulation. There was a significant main effect for the task factor ($F = 17.75$, $p < .001$). The differences in means were in the expected direction and give confirmation to the anticipated effect ($\bar{X}_{amb} = 26.8$, $\bar{X}_{str} = 36.6$).

We should also add that there was a significant effect of leadership style on the task structure items as well ($F = 5.80$, $p < .05$). While this result is substantially weaker than the task structure manipulation it does suggest that the structuring leader's behavior had some effect on the perceptions of task structure and that these two variables (leadership style and task structure) may not be entirely independent.

Since questions about the specificity of goal setting would make little sense to the no goals group, no questions were asked about this factor.

Link #1: Performance

The primary focus of our analysis will be for the goal period (GP) performance measures, inasmuch as this condition includes all of the independent variables whereas the learning period did not include the goal-setting manipulation. We should mention, however, that the covariate adjustments for ability resulted in no main effects for any of the performance measures and no further discussion of the ability measure is presented.

For the total completion measure, there was a significant main effect for task structure ($F = 10.96$, $p < .002$) and leadership style ($F = 14.44$, $p < .001$). People <u>completed</u> more items on the ambiguous task than on the structured task ($\bar{X}_{amb} = 26.19$, $\bar{X}_{str} = 17.43$) and they completed more items with the IS leader than with the CONS leader ($\bar{X}_{IS} = 25.61$, $\bar{X}_{CONS} = 18.05$). In addition, the three-way interaction was significant ($F = 5.11$, $p \leq .028$) but uninterpretable.

The source of the performance completion (GP-C) variance can be further examined by looking at performance when it is partitioned into accuracy (GP-A) and errors (GP-E). The analysis of variance indicated that the accuracy portion of completion was the primary source of variance for leader

effects ($F = 14.36$, $p < .001$), whereas the error portion of completion was the primary source of variance for task differences ($F = 34.76$, $p < .001$). In other words, the IS leader produced higher accuracy than the CONS leader ($\bar{X}_{IS} = 15.97$, $\bar{X}_{CONS} = 9.65$), while a structured task had fewer errors than the ambiguous task ($\bar{X}_{str} = 3.79$, $\bar{X}_{amb} = 13.94$). These were the only main effects or two-way interactions that were significant.

One surprising result was the lack of a goal-setting effect. One possible explanation for this lack of a main effect was that scores between the goal and no goal groups might not have been equivalent in the learning period, as is assumed with random assignment. Examination of the column means in Table 1 between these two groups confirms that suspicion. The no goal group started out with significantly higher performance than the goal group.

Insert Table 1 about here

Since the gains made from the learning period to the goal period seemed greater for the assigned goal condition than for the no goal condition, one could examine the significance of that increase by treating the learning period and goal period as repeated measures, and doing a repeated measures analysis of covariance. If the goal setting treatment were to produce an effect, one would expect it to show up as a period x goal interaction effect. This P x G effect was not significant. There was, however, a significant period effect ($F = 72.98$, $p < .001$) suggesting that both the specific and general goal conditions increased significantly rather than the specific goal condition showing a significantly greater increase than the increase obtained in the general goal condition.

TABLE 1

Column Means of Performance for Goal Conditions

	Learning Period			Goal Period		
	Goals Group	No Goals Group		Goals Group	No Goals Group	
Completion	9.34	13.19	t = 2.40**	20.95	22.90	n.s.
Accuracy	5.19	7.16	t = 1.58*	12.92	12.91	n.s.
Error	4.15	6.03	t = 1.47*	8.02	9.99	n.s.

Note: The score is performance units per hour within the designated period.

*p < .05

**p < .01

An alternative check for a goal effect was to treat the no goal group and the goal group as separate. We did a "t" test for their performance scores during the LP and GP for each goal condition, and anticipated a nonsignificant "t" value for the general goal group and a significant "t" for the specific goal group. In this analysis, all six comparisons (three performance measures for each of the two goal-setting conditions) were significant. That is, both groups showed significant increases. And, although the gains were greater for the specific goal group, they apparently were not significantly greater than the general goal conditions as noted by the lack of effects for the P x G interaction in the repeated measures analysis.

Link #1: Satisfaction

The JDI measure of satisfaction produced no between-cell differences that were significant, nor was satisfaction related to performance to a significant degree. The development and validation of the JDI has occurred primarily in ongoing work settings, and may not have been sensitive enough for the short-term job experienced by the employees in this research.

In summary, the results for link #1 show that structuring leaders produce higher accuracy than considerate leaders and a structured task results in fewer errors than an ambiguous task. There was no effect for goal setting and there were no significant relationships between the independent variables and job satisfaction or satisfaction with supervision.

Link #2: Perceptions of Subordinates

Environmental Uncertainty--Although environmental uncertainty (EU) is treated in this study as a potentially important moderator variable, it will be treated here first as a dependent variable in the analysis to clarify our understanding of the impact of task structure, leadership style, and goals on EU.

With EU as a dependent variable in a 2 x 2 x 2 analysis of variance there was a main effect for task structure ($F = 12.30$, $p \leq .008$) and a two-way leader x goal interaction effect ($F = 8.75$, $p \leq .019$). The main effect demonstrates that structured tasks produce higher certainty than do unstructured tasks ($\bar{X}_{str} = 23.44$, $\bar{X}_{amb} = 19.15$) as one would expect. (A higher score on EU means more certainty). The graph in Figure 5 illustrates the interaction effect.

Insert Figure 5 about here

The interaction pattern in Figure 5 is consistent for both the structured and unstructured task. Regardless of the task, CONS leaders obtain increases in certainty under goal conditions, and IS leaders produce decreases in certainty under goal conditions. It appears that having a goal with a structuring leader produces less certainty (on either task) than when either the goal is general or the leader is considerate.

Behavioral Uncertainty--This construct was measured by summing 11 behavior-outcome expectancy scores for each of three outcomes. A 2 x 2 x 2 analysis of variance was conducted for each of these composites. For outcome A (good performance rating), there was a marginally significant effect for leadership style ($F = 3.40$, $p \leq .069$). For outcome B (peer acceptance) there was a main effect for leadership style ($F = 9.57$, $p < .01$) and a two-way T x G interaction effect ($F = 4.82$, $p \leq .05$). For outcome C (sense of accomplishment) there was a near significant effect for task structure ($F = 4.96$, $p \leq .059$), a significant leadership style effect ($F = 5.19$, $p \leq .03$) and a two-way (T x L) interaction effect ($F = 4.04$, $p \leq .05$).

All three sets of behavioral uncertainty measures were significantly decreased by a structuring leadership style. The groups led by IS leaders had means of 82.07, 48.26, and 64.71, respectively for outcomes A, B and C, and the CONS leader groups had means of 72.25, 27.80, and 54.76 for the same three outcomes (note again that high scores mean a high probability and therefore less uncertainty).

The marginally significant task structure effect for outcome C suggested that the structured task produced more certainty than the ambiguous task ($\bar{X}_{str}$ = 71.55, $\bar{X}_{amb}$ = 63.74). The two-way interactions accounted for little variance and require a more lengthy explanation than space permits. A more detailed discussion is available elsewhere (Heed, 1978).

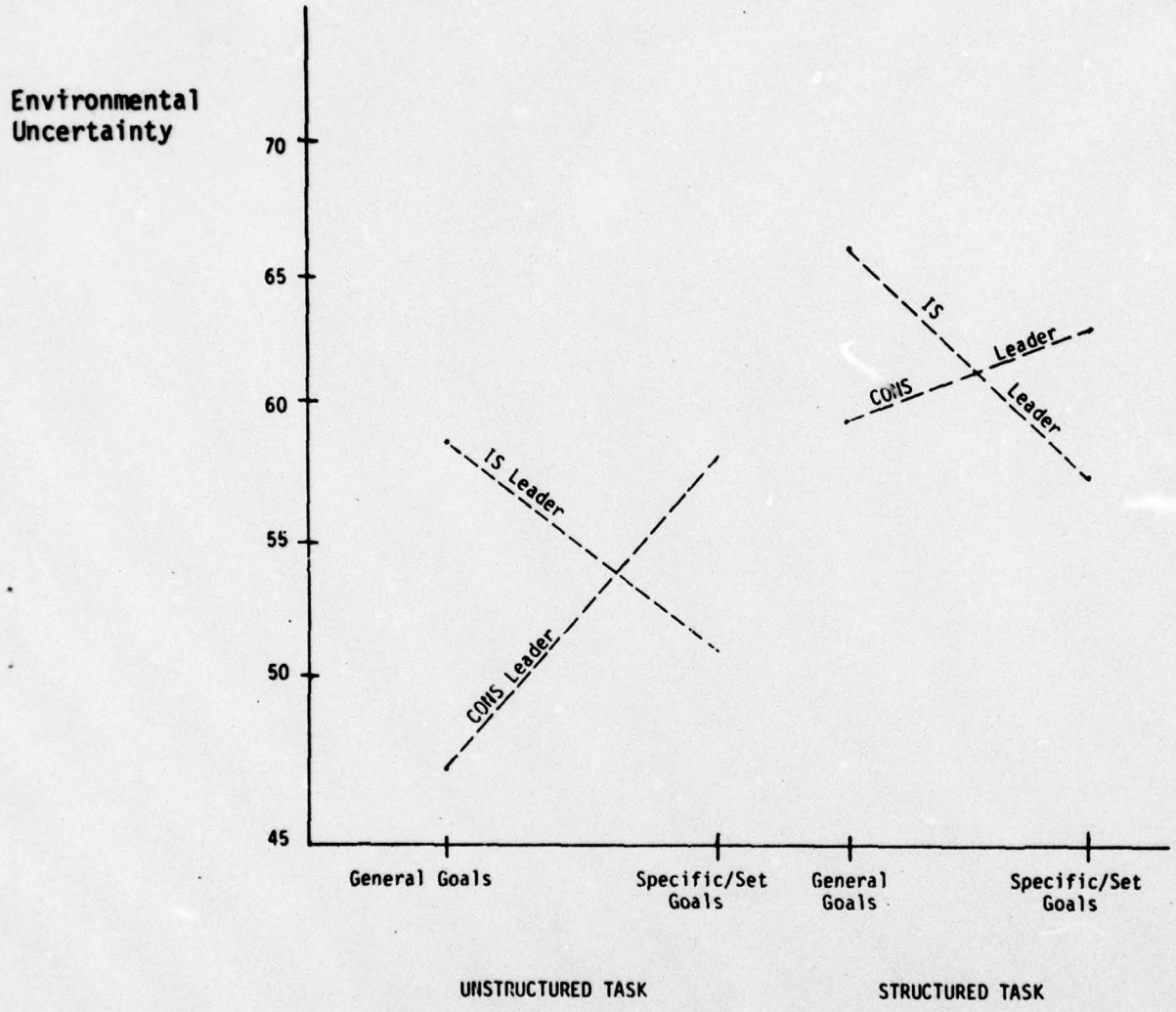
In summary, the results are generally supportive of the hypotheses. Environmental uncertainty was primarily affected by the structure of the task; less uncertainty resulted from a structured task. Behavioral uncertainty, on the other hand, was most affected by the leader's style. The more structuring the leader the lower the uncertainty. Goal setting had little impact on either uncertainty measure.

Link #3: Uncertainty-Criterion Relationships

Having learned something about the effects of the situational factors on environmental and behavioral uncertainty, the next section examines the relationship of these same perceptual measures to satisfaction and the performance measures: GP-C, GP-A, and GP-E. These relationships are reported in Table 2, and the analysis gives some support for the hypothesized linkage between the cognitive measures and the performance and satisfaction criteria. In general, the analysis suggests that as EU decreases (employees perceive more certainty) accuracy is higher, error is lower, and employees

FIGURE 5

Leader by Goal Interaction Effects for Environmental Uncertainty in Each Task Condition



NOTE: Higher scores mean more certianty (EU)

are more satisfied with the task and the supervisor. Increases in expectancy "A" were related to increases in satisfaction with supervision, increases in expectancy "C" were related to reduced errors and satisfaction with the task and supervision. Using all 33 expectancies as a sum, increased certainty was related to increased accuracy and increased satisfaction with the task and supervision.

Insert Table 2 about here

These results, while not terribly strong do support the hypothesis that uncertainty can serve as a potential moderator of the environmental-outcome relationships. In general, a structuring leadership style and a structured task increase behavioral and environmental certainty. This increase in certainty results in higher performance and satisfaction.

DISCUSSION

The intent of this study was to examine the differential and causal contribution of situational factors to psychological uncertainty and subordinate performance. We also examined the impact of the psychological variables on performance. For the most part the intent of the study was successfully realized. We found that performance differences between groups occurred as a result of the systematic variation of the three dichotomized situational factors (eight combinations). These findings lend support to the interactionist approach to understanding work performance. Attention to specific performance dimensions helped to identify the effects of those situational factors. In addition, there was moderate support for the predicted relationship between the situational factors and psychological variables, as well as the psychological variables-performance link.

TABLE 2

Correlation Analysis: Moderator-Criterion Relationships

	Performance			Satisfaction	
	Completion (GP-C)	Accuracy (GP-A)	Error (GP-E)	Supervisor	Task
Environmental Uncertainty	-.01	.27**	-.27**	.23**	.29**
Expectancy A (performance rating)	.07	.13	-.02	.17*	.04
Expectancy B (peer acceptance)	.10	.12	.04	.06	.15
Expectancy C (sense of accomplishment)	-.12	.07	-.23**	.17*	.22**
All 33 Expectancies	.09	.26**	-.11	.22**	.19*

*p < .10

**p < .05

Leadership Style, Task Characteristics, and Goal-Setting Effects on Performance

We set out to determine the causal relationship of the three independent variables to performance. By tracing the task structure, leadership style, and interaction effects to the accuracy and error components of performance, we were able to make an accurate assessment of the independent variable effects. In that context, the main effect for leadership style occurred with the accuracy performance score. Structuring leaders had higher accuracy than considerate leaders. Apparently, the close supervision increased the employees' attention to their work.

The task structure effects were evident in the error performance score and can most easily be explained by stating that the structured task, through allowing for fewer personal degrees of freedom, had fewer errors but equivalent accuracy scores. That is, there was not higher accuracy, but rather a lower error score for the structured task condition than the unstructured condition. The employees working on the unstructured task moved at a more rapid pace, but this increase compared to the structured task group was gained at the expense of the quality of work produced. An unstructured task resulted in greater quantity but lower quality performance than the structured task.

One of the most surprising findings was the lack of a significant main effect for differences between the two goal-setting conditions. One possibility is suggested by the fact that both conditions showed a significant increase over their performance in the learning period, and therefore <u>both</u> the general "do your best" and the specific/set goal had a positive effect. In light of the accumulation of evidence in the literature that specific goals do better than general ones this explanation doesn't seem very plausible.

A second possibility is that the increase for both goal conditions was due to continued learning that was occurring during the goal period, and that both groups were simply getting better by practice. This argument is tempered somewhat by the fact that in the pretesting of the task, nearly all the employees obtained an adequate proficiency level, mastered the operations and procedures, and were able to work on their own without asking questions or receiving assistance by the end of the learning period. In addition, to the extent that our measure of ability is related to the ability required to learn this task, the analyses suggests that learning differences were in effect during the learning period but were minimized in the goal period. That is, performance measures were correlated with our ability measure in the learning period but not in the goal period.

A third explanation for the non-effect of goal setting is that there may well be contingencies to goal-setting efficacy. Although we had stated only a general hypothesis that goals do better than no goals it appears we have some evidence now which will encourage us to look more closely and systematically at goal-setting effects as moderated by other situational factors.

Finally, there is the chance that the manipulation did not work. Since we failed to obtain a manipulation check we cannot directly address this possibility although the use of similar manipulations have proven effective in other studies (e.g., Umstot, Bell & Mitchell, 1976; White, Mitchell & Bell, 1977).

Environmental Uncertainty and Behavioral Uncertainty

The second set of relationships in which we were interested were those which existed in a causal way between the situational factors and the

psychological variables of environmental and behavioral uncertainty. The perceptual/psychological measures were obtained with the expectation that they would (a) be responsive to situational differences, and (b) provide an explanation of performance variance. The measures were in fact responsive to situational variation, and in a manner that had been predicted relative to leadership style and task structure. The results obtained for goal-setting, however, were not as predicted nor were they easily interpretable.

More specifically, the prediction that structured tasks would lead to lower environmental uncertainty was supported. Also, IS leaders produced higher levels of certainty on the behavioral uncertainty measures as predicted. Theoretically, this makes sense in that the task structure (an external variable) was related to environmental uncertainty, and the leader behavior (an interpersonal, behavioral measure) was related to behavioral uncertainty which focused on behavior.

The goal-setting treatment did not produce main effect differences in any of the psychological/perceptual measures. It had been anticipated that systematic differences in the psychological measures would be concomitant with the systematic variation in the situational variables. Inasmuch as the predicted effect did not occur, this could mean (a) that the goal-setting didn't have any impact, or (b) that it didn't register any impact on the constructs and measures utilized in this study. The latter explanation would fit Locke's (1975) interpretation of the psychological process associated with goal-setting. He maintains that behavioral intention (established by goal-setting) is the salient psychological construct. Not having measured that construct in this study, we have no basis for supporting or refuting Locke's explanation. Also, without a manipulation check we cannot be sure of the strength of our manipulation. In summary, the goal-setting treatment does

not produce a simple increase in certainty and expectancy as had been predicted, and apparently the psychological impact may be more complex than had been envisioned.

Moderator-Criterion Relationships

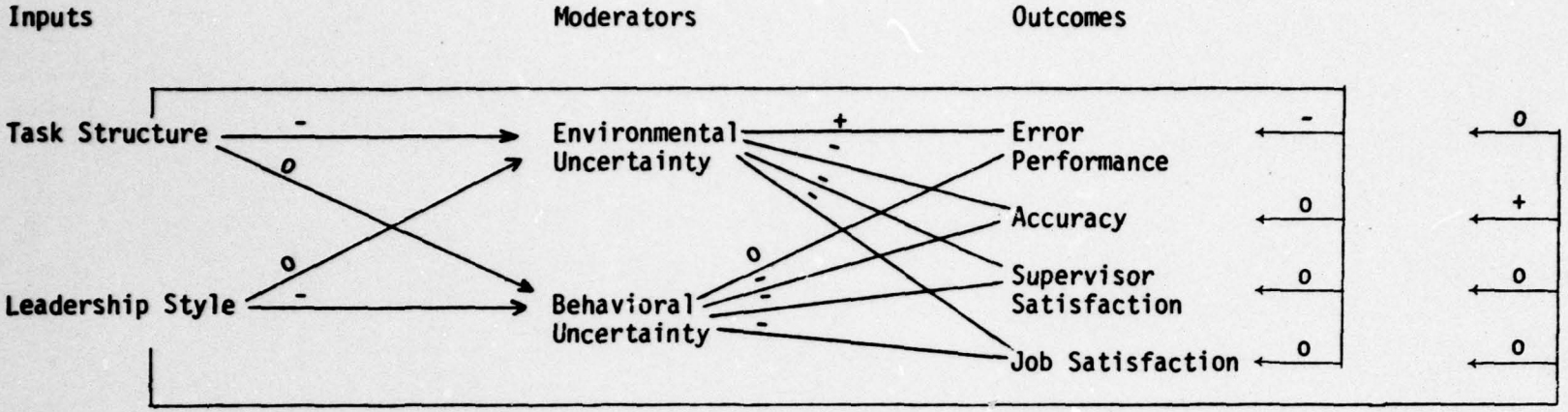
The third set of relationships attended to in this study were those which were predicted to exist between the perceptual/psychological measures and the performance measures. Although we cannot infer the causal direction with these relationships as we could with the situation-performance and situation-perception relationships, it is nevertheless instructive to see that the relationships at least exist for this work setting. It allows us to describe more fully the chain of events, both situational and psychological, that lead to the performance differences we initially set out to understand. Although many subtleties could be drawn from the data, and the interaction effects complicate the interpretation, the primary linkages established by the main effects are diagrammed in Figure 6.

Insert Figure 6 about here

Although this figure oversimplifies the data, it shows the pattern for the main relationships. Overall, the treatments, measurements, and theoretical support generated from the analyses were encouraging. The independent variables of a structured task and a structuring leadership style reduced perceptions of uncertainty. This reduced uncertainty was in turn related to higher performance and satisfaction. A desirable next step would be to study these variables in a field setting over extended time periods.

FIGURE 6

A Summary of the Empirical Relstionships



Goal Setting - $\overset{o}{-}$ -

*p < .05 for correlations

Note: For the Inputs → Moderators relationships a negative sign (-) means increased structure (either task or leader behavior) caused reduced uncertainty. For the Inputs → Outcomes relationships a negative sign means increased structure resulted in less of the outcome (e.g. error) while a positive sign indicates that increased structure resulted in more of the outcome (e.g. accuracy). For the Moderators → Outcomes relationships a positive sign means increased uncertainty led to increases in the outcome (e.g. error) while negative signs mean increases in uncertainty led to decreases in the outcome (e.g. accuracy).

FOOTNOTE

[1]This research was supported by Office of Naval Research Contract N00014-76-C-0193 (Terence R. Mitchell and Lee Roy Beach, Investigators). The authors wish to thank Gary Latham for his helpful comments on an earlier draft of the paper.

REFERENCE NOTE

1. Shaw, M. E. Scaling Group Tasks: A Method of Dimensional Analysis. Technical Report No. 1, 1963, University of Florida, Contract Nonr 580 (11) - NR 170-266, Office of Naval Research.

REFERENCES

1. Brief, A. P., and R. J. Aldag. "Correlates of Role Indices," Journal of Applied Psychology, Vol. 61 (1976), 468-472.
2. Brown, A. "Reactions to Leadership," Educational Administration Quarterly, Vol. 3 (1967), 62-73.
3. Fiedler, Fred E. A Theory of Leadership Effectiveness (New York: McGraw-Hill, 1967).
4. Latham, Gary P., and G. A. Yukl. "A Review of Research on the Application of Goal Setting in Organizations," Academy of Management Journal, Vol. 18 (1975), 824-845.
5. Locke, E. A. "Toward a Theory of Task Motivation and Incentives," Organizational Behavior and Human Performance, Vol. 3 (1968), 157-189.
6. Locke, E. A. "Personnel Attitudes and Motivation," Annual Review of Psychology, Vol. 18 (1975), 457-479.
7. MacCrimmon, K. R., and D. N. Taylor. "Decision Making and Problem Solving," in M. D. Dunnette (Ed.), The Handbook of Industrial and Organizational Psychology (Chicago: Rand McNally, 1976).
8. Miles, R. H. "A Comparison of the Relative Impacts of Role Perceptions of Ambiguity and Conflict by Role," Academy of Management Journal, Vol. 19 (1976), 25-35.
9. Mitchell, Terence R., C. M. Smyser, and Stan E. Weed. "Locus of Control: Supervision and Work Satisfaction," Academy of Management Journal, Vol. 18 (1975), 623-631.
10. Steers, R. M., and L. W. Porter. "The Role of Task-Goal Attributes in Employee Performance," Psychological Bulletin, Vol. 81 (1974), 434-452.

11. Stogdill, R. M. Manual for the Leader Behavior Description Questionnaire--Form XII (Columbus: Bureau of Business Research, Ohio State University, 1963).

12. Stogdill, R. M. Handbook of Leadership: A Survey of Theory and Research (New York: The Free Press, 1974).

13. Szilagyi, A. D., Jr., H. P. Sims, Jr., and R. T. Keller. "Role Dynamics, Locus of Control and Employee Attitudes and Behavior," Academy of Management Journal, Vol. 19 (1976), 259-276.

14. Umstot, D. D., Cecil H. Bell, and Terence R. Mitchell. "Effects of Job Enrichment and Task Goals on Satisfaction and Productivity: Implications for Job Design," Journal of Applied Psychology, Vol. 61 (1976), 379-394.

15. Weed, Stan E. The Effects of Situational Factors on Uncertainty, Expectancy and Performance (Ph.D. dissertation, University of Washington, 1978).

16. Weed, Stan E., Terence R. Mitchell, and W. Moffitt. "Leadership Style, Subordinate Personality, and Task Type as Predictors of Performance and Satisfaction with Supervision," Journal of Applied Psychology, Vol. 61 (1975), 58-66.

17. White, Sam, Terence R. Mitchell, and Cecil H. Bell. "Goal Setting, Evaluation Apprehension and Social Cues as Determinants of Job Performance and Job Satisfaction in a Simulated Organization," Journal of Applied Psychology, Vol. 62 (1977), 665-673.

18. Wonderlic, E. F. Wonderlic Personnel Test Manual (Northfield: E. F. Wonderlic and Associates, Inc., 1970).

Office of Naval Research
(Code 452)
800 N. Quincy St.
Arlington, VA 22217

Director
U.S. Naval Research Laboratory
Washington, DC 20390
ATTN: Technical Info. Division

Defense Documentation Center
Building 5
Cameron Station
Alexandria, VA 22314

Library, Code 2029
U.S. Naval Research Laboratory
Washington, DC 20390

Science & Technology Division
Library of Congress
Washington, DC 20540

Psychologist
ONR Branch Office
495 Summer St.
Boston, MA 02210

Psychologist
ONR Branch Office
1030 E. Green St.
Pasadena, CA 91106

Research Psychologist
ONR Branch Office
536 S. Clark St.
Chicago, IL 60605

Director
Cybernetics Technology Office
ARPA, Room 625
1400 Wilson Blvd.
Arlington, VA 22209

Dr. H. Russell Bernard
Dept. of Sociology & Anthro.
West Virginia University
Morgantown, WV 26506

Dr. Arthur Blaiwes
Naval Training Equipment Ctr.
Orlando, FL 32813

Dr. Arie Lewin
Duke University
Duke Station
Durham, NC 27706

Dr. Lyman W. Porter
University of California
Dean, Grad. School of Admin.
Irvine, CA 92650

Dr. Paul Wall
Division of Behavioral Science
Tuskegee Institute
Tuskegee, AL 36088

Navy Personnel R & D Center
Code 01
San Diego, CA 92152

Director, Engineering Psych.
Programs, Code 455
Office of Naval Research
800 North Quincy Street
Arlington, VA 22217

Lt. Col. Henry L. Taylor, USAF
OAD(E&LS) ODDR&E
Pentagon, Rm. 3D129
Washington, DC 20301

Pers. Logistics Plans, OP987P10
Office of the Chief of Naval
Operations
Department of the Navy
Washington, DC 20350

Dr. A. L. Slafkosky
Scientific Advisor
Commandant of the Marine Corps
Code RD-1
Washington, DC 20380

Office of Naval Research
International Programs
Code 102IP
800 North Quincy Street
Arlington, VA 22217

Naval Analysis Programs, 431
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

Operations Research Prog., 434
Office of Naval Research
800 N. Quincy Street
Arlington, VA 22217

Capt. Paul Nelson
Naval Medical R&D Command
Code 44
Naval Medical Center
Bethesda, MD 20014

Director, Behavioral Sciences
Department
Naval Medical Research Inst.
Bethesda, MD 20014

Dr. George Moeller
Head, Human Factors Engin. Br.
Submarine Medical Research Lab.
Naval Submarine Base
Groton, CT 06340

Bureau of Naval Personnel
Special Asst. for Res. Liaison
PERS-OR
Washington, DC 20370

Dr. Fred Muckler
Manned Systems Design, Code 311
Navy Personnel Research and
Development Center
San Diego, CA 92152

LCDR P. M. Curran
Human Factors Engineering Br.
Crew Systems Department
Naval Air Development Ctr.
Johnsville, Warminster, PA 18974

Dr. Alfred F. Smode
Training Analysis & Eval. Group
Naval Training Equipment Ctr.
Code N-00T
Orlando, FL 32813

Dr. Gary Poock
Operations Research Department
Naval Postgraduate School
Monterey, CA 93940

Mr. J. Barber
Headquarters DA, DAPE-PBR
Washington, DC 20546

Dr. Joseph Zeidner
Dir., Org. & Sys. Res. Lab.
U.S. Army Research Institute
5001 Eisenhower Ave.
Alexandria, VA 22304

Dr. Edgar M. Johnson
Organizations & Sys. Res. Lab.
U.S. Army Research Lab.
5001 Eisenhower Ave.
Alexandria, VA 22304

Technical Director
U.S. Army Human Engineering Labs
Aberdeen Proving Ground
Aberdeen, MD 21005

U.S. Air Force Office of
Scientific Research
Life Sciences Directorate, NL
Bolling Air Force Base
Washington, DC 20332

Dr. Donald A. Topmiller
Chief, Systems Effect. Branch
Human Engineering Division
Wright Patterson AFB, OH 45433

Lt. Col. Joseph A. Birt
Human Engineering Division
Aerospace Medical Research Lab.
Wright Patterson AFB, OH 45433

Lt. Col. John Courtright
Headquarters
AMD/RDH
Brooks AFB, Texas 78235

Dr. Jessee Orlansky
Institute for Defense Analyses
400 Army-Navy Drive
Arlington, VA 22202

Journal Supp. Abstract Service
American Psychological Assoc.
1200 17th Street, NW
Washington, DC 20036

Dr. Victor Fields
Montgomery College
Dept. of Psychology
Rockville, MD 20850

Dr. Robert R. Mackie
Human Factors Research, Inc.
Santa Barbara Research Park
6780 Cortona Drive
Goleta, CA 93017

Mr. Alan J. Pesch
Eclectech Associates, Inc.
Post Office Box 179
North Stonington, CT 06359

Dr. A. I. Siegel
Applied Psychological Services
404 East Lancaster Street
Wayne, PA 19087

Dr. W. S. Vaughan
Oceanautics, Inc.
3308 Dodge Park Road
Landover, MD 20785

Director, Human Factors Wing
Defense & Divil Institute of
Environmental Medicine
P.O. Box 2000
Downsville, Toronto, Ont., CAN.

Dr. A. D. Baddeley
Director, Applied Psych. Unit
Medical Research Council
15 Chaucer Road
Cambridge, CB2 2EF ENGLAND

Prof. Dr. Carl Graf Hoyos
Institute for Psychology
Technical University
8000 Munich - Arcisstr 21
FEDERAL REPUBLIC OF GERMANY

Dr. William A. McClelland
Human Resources Research Office
300 N. Washington Street
Alexandria, VA 22314

Major David Dianich
DSMS
Building 202
Fort Belvior, VA 22060

Dr. C. Kelly
Decisions and Designs, Inc.
Suite 600
7900 Westpark Drive
McLean, VA 22101

Dr. Paul Slovic
Oregon Research Institute
Post Office Box 3196
Eugene, OR 97403

Dr. Amos Freedy
Perceptronics, Inc.
6271 Variel Avenue
Woodland Hills, CA 91364

Dr. R. A. Howard
Stanford University
Stanford, CA 94305

Dr. Ward Edwards
Director, Social Science
Research Institute
University of South. California
Los Angeles, CA 90007

Robert G. Gough, Major, USAF
Associate Professor
Department of Economics,
Geography and Management
USAF Academy, Colorado 80840

Dr. T. Owen Jacobs
P.O. Box 3122
Ft. Leavenworth, KS 66027

Dr. Delbert M. Nebeker
Department of the Navy
Navy Personnel Res. & Dev. Ctr.
San Diego, CA 92152

Professor Ken Hammond
Department of Psychology
University of Colorado
Boulder, CO 80302

Dr. Charles Gettys
Department of Psychology
University of Oklahoma
Norman, OK 73069