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AN ABSTRACT OF THE THESIS OF Richard Everett Boggs for the Master of Science in Psychology presented May 22, 1970

Title: Attitudes Toward Supervision, Job Satisfaction, and Risk-Taking Behavior and the Relationship to Accident Frequency Ratios.

APPROVED BY MEMBERS OF THE THESIS COMMITTEE:

Milton Davis, Chairman

Robert Powloski

Morris Weitman

This study investigates the efficacy of Kerr's (1957) "Goals-Freedom-Alertness" (GFA) theory of accident causation and Likert's (1961) theory of dissimilar attitudes between supervisory levels as applied to the U.S. Forest Service. There are two types of ranger districts, those rated high and low on the basis of accident frequency ratios. From each district four subjects from each of two supervisory levels were administered a battery of ten scales. The overall results indicate that neither GFA theory was supported on the district variable, nor Likert's theory on the supervisor variable. The results independent of theory do indicate that the manner in which the district

ranger is seen by his immediate subordinates is related to accident frequency.

ATTITUDES TOWARD SUPERVISION, JOB SATISFACTION,
AND RISK-TAKING BEHAVIOR AND THE RELATIONSHIP
TO ACCIDENT FREQUENCY RATIOS

by

RICHARD EVERETT BOGGS

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE
in
PSYCHOLOGY

Portland State University
1970

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May 22, 1970

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CHAPTER I

THEORY

In the past the study of accidents has focused on accident proneness, a factor within the individual with an almost total neglect of the situational factors which are related to accident-free or accident susceptible employees. It has been shown by Mintz and Blum (1949), that frequency of "repeater" accidents approximates a pure chance (Poisson) distribution. Maritz (1951) suggested that a test of variance of the industrial accident rate accounted for by proneness is the correlation between a worker's accidents experienced over two different periods of work exposure, such as the last two years and the next two years. This would give us some idea of the statistical reliability of individual accident rate. Kerr (1957) has computed the median of 18 such coefficients and obtained a value of .38. This value suggests that approximately 15 per cent of variance in individual accident rates is accounted for by variance in individual accident proneness. In addition, it is almost certain that some, if not all, of the 15 per cent of potential variance attributed to accident proneness is confounded with environmental factors. Forbes (1939) came to the conclusion that the accident repeated contributes not more than 3 or 4 per cent to the accident problem.

The accident proneness theory is obviously not a complete explanation of accident causation. Another theory that will help

account for more of the variance is Kerr's "Adjustment-Stress" theory. It holds that unusual negative, distracting stress upon the organism increases its liability to incur accidents or other low quality work behavior. This is a climatic theory, stress from the environment is internal (alcohol, drugs, toxic intakes) as well as external (excessive work, noise level). It differs from accident proneness in that accident proneness assumes a factor within the psychological make-up of the individual. The difference between proneness factors and adjustment stress factors is easily confused. What appears to be an accident proneness factor within the individual may on closer examination be a temporary stress factor. Temporary external stress factors which are correlated significantly with accident rates are workplace temperature (Griffin, 1950), illumination (Vernon, 1931), mean comfort of the shop (Keenan, 1951), high seasonal layoff rate, blighted living conditions, and where there was a record of many garnisheed wages (Kerr, 1957). Although external stress factors have been investigated, the problem of getting a measure of the intensity of temporary internal stress factors in the field situation presents many difficulties.

The third theory of accident causation is Kerr's "Goals-Freedom-Alertness" theory. Kerr holds that freedom to set reasonably attainable goals is accompanied typically by high-quality work performance. This theory regards an accident merely as low-quality work behavior. Raising the level of quality involves raising the level of alertness; such high alertness cannot be sustained except within a rewarding psychological climate. The richer the climate is in diverse (economic and non-economic) reward opportunities the higher the level of alertness and

the higher the level of work quality. The rewards system must be geared to support high-quality work behavior. The "Goals-Freedom-Alertness" theory is also consistent with McGregor's theory Y assumptions (1960) and Herzberg's (1959) findings on satisfiers.

In practice business usually offers too much "telling what to do and what not to do" and too little encouragement to the worker to do his own thinking and "stand on his own feet". When an accident occurs it occurs in a climate in which the employee is expected to supply his energy but not his opinions or ideas. According to Kerr, the climate must encourage the individual to participate and therefore form habits of alertness, problem raising, and problem solving. The work climate must reward the worker for being alert, for making constructive suggestions and for achievements (out of the ordinary). The worker must feel free to exercise influence over his environment.

By measuring certain elements of the work climate predicted by GFA theory (attitudes toward supervision, supervisors, job satisfaction, and risk-taking behavior) it is hoped that a relationship can be established between attitudes (predicted from theory) and accident frequency. In addition to an investigation of GFA theory and attitudes connected with low and high-accident rated units, there is another area of attitudes between managers and foremen¹ and the influence which is inferred from this similarity. In the units under study the managers (principal management assistants, PMAs) operate in the functional areas

¹Another study is being conducted by Neil Davidson, Department of Psychology, Portland State University, to investigate the similarity of attitudes between foremen and workers.

with 2 to 4 foremen reporting to them. The foremen (Crew Chiefs, CCs) are defined as those full-time employees with 3 or more employees working for them. Fleishman (1953) has investigated the similarity of attitudes toward supervision after human relations training designed to change supervisory attitudes. Fleishman found that no matter how strong the registered change of attitudes toward supervision after training the foreman's supervisory behavior will revert to the methods that are reinforced by the higher level manager in his unit. Therefore, any benefits which might have been brought about by training were nullified. From these findings it would suggest that if the manager and foreman were in close geographic proximity to each other (as in Fleishman's study) they would not differ in attitudes and supervisory behavior. This is not the case with the subjects under consideration; they are not in close geographic proximity.

Likert's general theory (1961) is one in which the decision levels are pushed down (more decentralized authority within the work crew), and the workers are given more general supervision, a theory not inconsistent with GFA theory. Although Likert presents no data of his own on attitude similarity or influence between managers and foremen, he has this to say concerning attitude similarity.

With each successively higher level of management (at least to middle management) superiors tend to place more emphasis than do the subordinates on the desirability of having the supervisor concerned primarily with pressure for higher production, better quality, and lower costs. (Brooks, 1955. Gordon, 1955) Management appears to be asking supervisors to behave in a manner likely to yield poor results in the long run even though short run improvement may be achieved.²

²Rensis Likert, New Patterns of Management. (New York, 1961), p. 19. Permission to quote the material has been asked of the publisher, McGraw-Hill Book Co., Inc.

From this we would hypothesize that there will be no consistent similarity between foremen and managers' attitudes, and there will be significant differences between levels of supervision. It is felt that Likert's theory and his report of manager action has more applicability; Fleishman's findings concerning attitude similarity are the result of managers and foremen working in close physical proximity to each other, which is not always the case in the units under study.

CHAPTER II

METHODS

The GFA accident causation theory would predict that if the individual is allowed freedom to set his own reasonably attainable goals the result will be high-quality (accident-free) performance. The underlying assumption is that the individual is reasonably trained in the method of doing his job. Although there are no direct methods employed in measuring "freedom to set goals", an attempt has been made to employ an instrument that will measure it indirectly. The Leadership Opinion Questionnaire³ of Fleishman (1953), is a description by the supervisor about how he leads. The Leader Behavior Questionnaire (Fleishman, 1953) is made up of 40 items that are identical in content to those which appear on the Leader Opinion Questionnaire. They have been altered only slightly to fit the purpose of the scale, which is that of describing how your immediate supervisor leads. Both the Leader Opinion Questionnaire and the Leader Behavior Questionnaire measure on two independent scales, structure and consideration. Structure is defined as the extent to which an individual is likely to define and structure his own role and those of subordinates toward goal attainment. He does this by a high degree of planning, scheduling, criticizing, initiating his ideas and organizing the work. An example of a structure

³Test-retest reliability for the Structure Scale is from .67 to .88, for the consideration scale .62 to .89.

item taken from the Leadership Opinion Questionnaire:

Insist that persons under you follow to	☐ _always
the letter those standard routines handed	☐ _often
down to you.	☐ _occasionally
	☐ _seldom
	☐ _never

The inference made from GFA theory is that a supervisor who is highly structured will severely limit the amount that an individual is allowed to set his goals and that this will be done in an authoritarian manner. The result will be a lower level of alertness and the quality of work will decline, resulting in accidents. Those units rated high in accident frequency will have highly structured supervisory personnel.

Likert's theory (1961) suggests that there will be no consistent similarity between foremen and managers. If this is the case, then there will be no consistent similarity in structure between managers and foremen, and there will be significant differences between the two levels.

Consideration consists of a job relationship characterized by mutual trust, respect for subordinate's ideas, consideration of their feelings, and a certain warmth between supervisor and subordinates. An example of a consideration item taken from the Leadership Opinion Questionnaire:

Put suggestions made by persons in the	☐ _often
unit into operation.	☐ _fairly often
	☐ _occasionally
	☐ _once in a while
	☐ _very seldom

The inference drawn from this scale is that a supervisor high in consideration will allow his men to set reasonable attainable goals. According to GFA theory, the result will be a higher level of alertness and the quality of work will increase, resulting in fewer accidents. Those subjects (Ss) which are in ranger districts rated low in accident frequency will have high consideration supervisory personnel.

According to Likert's (1961) theory there will be no consistent similarity between foreman and managers. If this is the case then there will be significant differences between formen and managers on the consideration scale.

The Job Descriptive Index⁴ (Smith, 1967) is an adjective checklist used by the respondent to describe five areas of his job (work, immediate supervisor, people you work with, pay, promotion opportunities). Satisfaction is inferred from the way the respondent describes his job, either yes or no if the adjective applies. According to GFA theory, the richer the work environment in diverse reward opportunities, the higher the level of alertness and the higher the level of work quality, therefore fewer accidents.

The Choice Dilemma Scale⁵ of Wallach and Kogan (1961) is a twelve item scale in which each item represents a choice-dilemma between a risky and a safe course of action. The procedure is of a semi-projective nature. The respondent is asked to check the lowest

⁴The internal consistency reliability of the five JDI scales range from .80 to .88 as determined by corrected split-half correlation.

⁵Reliability of the Choice Dilemma Scale using the odd-even method corrected with Spearman-Brown formula ranges from .53 to .62.

probability that he would consider acceptable in the hypothetical situations. GFA theory would state that the setting of reasonably attainable goals will result in high quality work performance. The respondent must feel free to exercise influence over his environment. This theory is also consistent with McClelland's (1961) findings that highly achievement motivated individuals prefer to engage in moderate risk in which they have some influence over the outcome. If this is the case, then supervisory personnel in low accident rated units will be moderate risk takers, while those in high accident rated units will be high risk takers.

This study was carried out within Region 6 (Washington and Oregon) of the United States Forest Service. Accident frequency ratios (Heinrich, 1957) were computed for all forests within Region 6. The accident frequency ratio is derived by multiplying medical treatment plus lost time accidents by one million and dividing by the number of man hours worked in that unit. Medical treatment is defined as an accident which requires the attention of a physician; lost time accidents are those accidents in which the individual involved is not able to report for work on the next scheduled work day. In computing all-accident frequency ratios, all fire-fighting connected accidents and fire-fighting man hours were subtracted. Fire-fighting activities are particularly hazardous, and it would be unrealistic to compare units which had large forest fires with other units which had none. Also, many people from outside the unit come in to fight the fire and often are not supervised by home unit personnel.

In the selection of forests the adjusted accident frequency ratio was the first consideration. The forests were then selected on the basis of being predominately on the west side of the Cascades, heavy timber production, generally similar terrain, and similar climatic conditions.

Stability of supervision at all management levels was a factor in selecting forests. If the supervisory personnel had changed within the last six months the questionnaires would have less validity from which to draw inferences. (See Appendix C for length of service of District Rangers)

In subtracting fire-fighting hours and accidents all hours and accidents connected with fires were subtracted. Pre-suppression (slash-burning, etc.), which is handled at the district level and the hours and accidents incurred were included when computing accident frequency ratios.

Originally it was thought that adjusted lost-time accidents would be the criterion that would be most meaningful for computing accident frequency ratios. It was found that lost-time accidents alone were not sensitive enough to identify the critical units which were under investigation. (See Appendix D) --

It is felt that a two year average of adjusted all-injury accident frequency ratios (1967-68) would be more reflective of attitudes rather than a longer period, due to the mobility of personnel within the Forest Service.

In the final selection of forests (after the aforementioned classification system had been applied) it was decided to select two forests

which were low, two that were medium, and two that were high according to accident frequency ratios. To add some validity to this classification scheme, it was decided to do a one-way analysis of variance of the two year average of the accident frequency ratios of the Ranger Districts within the two forests rated as low, medium, and high. (See Appendix E, $F=.0031$, nonsignificant) It was decided that although these are representative forests (low, medium, and high) they are not significantly different with respect to accident frequency ratios over a two year average. All the variation among forests can be explained by the variation among Ranger Districts. Although these forests may be representative, the classification system of low, medium, and high according to accident frequency does not indicate significant differences.

It was then decided that low and high accident rated ranger districts from each of the 6 forests would be selected. Again the criteria were applied to ranger districts that were applied to forests to achieve a representative sample. An inspection of the two year average of (1967-68) accident frequency ratios of those selected as low and high ranger districts reveal that the highest of the ranger districts rated as low (52.93) is lower than the lowest of those ranger districts rated as high (66.37): there was no overlap. (See Appendix F, $F=15.44$, significant at $P=.01$) In this instance the classification scheme has held up to statistical test and we can say that there are statistical differences in ranger districts rated low and high by accident frequency ratios.

Organizationally, the United States Forest Service has divided the entire United States into a number of regions. Each region is broken

down into the Regional Office and a number of separate National Forests. Each National Forest is broken down into a Supervisors Office and a number of separate ranger districts. The top manager at the National Forest level is titled Forest Supervisor; at the district level, District Ranger. There are 19 National Forests in Region 6. The number of ranger districts within each National Forest ranges from 4 to 9.

All District Rangers and from 5 to 7 forest staff officers who are responsible for functional areas (timber, recreation, engineering, fire control, etc.) report to the Forest Supervisor. At the district level there are usually 4 or 5 principal management assistants (PMAs) who report to the District Ranger. Each PMA has functional responsibilities in the district that are similar to the functional responsibilities of the staff officers. There are usually from 2 to 4 crew chiefs or first line foremen who report to the PMA.

The direct chain of command has been outlined. However, the Forest Staff officers have some functional control over the activities of principal management assistants in the districts. Within the districts there may be more intermediate supervisory levels between the PMA and the crew chiefs. The number of crew chiefs will differ from ranger district to ranger district in terms of district work load, time of year, type of resource, and other factors. (See Appendix H for organizational chart)

The area of investigation consists of two levels of personnel within the ranger district, principal management assistants (PMA) and the crew chiefs (CC). Principal management assistants operate under the supervision of the District Ranger and informally under the

functional staff officer of the Forest Supervisor. This segment of the hierarchy was chosen because it closely approximates the hierarchial levels used by Fleishman (1953) and Likert (1961). The problem, as mentioned earlier, is that of trying to determine if there are significant differences in GFA attitudes with which we will be able to differentiate between high and low accident rated districts and at which supervisory level does this predominately occur. Likert predicts no consistent similarity in attitudes, but does not indicate directionality.

The PMAs and CCs who will be selected are those who work in the functional areas of timber, fire control, engineering, and miscellaneous resources. It has been shown that the functional areas of timber, fire control, and engineering account for approximately 75% of the accidents (Davis, 1969).

The subjects who received the test battery (See Appendix B for an example of the introductory letter) will be all the PMAs in low and high accident rated ranger districts and those CCs who fall within the following definition. Crew chiefs are defined as the level of personnel who are full time employees (at least 10 months per year), supervising 3 or more people and usually operating under the PMA in the functional areas. The test battery will be distributed through the channels within the Forest Service and returned by mail. It was initially thought that a response rate of from 80-90% would be the minimum acceptable standard. Closer consideration of this problem reveals that even with a response of from 80-90% that we may be lacking (PMAs) in certain functional areas and in some cases have an over supply of crew chief responses. It is imperative that we have PMA response in the functional

areas, the problem at the crew chief level is that of selecting (randomly) that crew chief which is representative of crew chiefs in general. The higher the response rate of crew chiefs the more representative this selection will be.

In gathering the information the first step was to identify supervisory levels within ranger districts. To attain this goal a memo was sent to all District Rangers in the districts under consideration, requesting a list of crew chiefs and giving the previously mentioned definitions of crew chiefs. A list of principal management assistants had been compiled from personal records. Upon receiving the lists, the questionnaires were assembled and distributed to the subjects by the Forest Service through their own mail channels on approximately July 1, 1969; by August 31, 1969 approximately 65.2% of the questionnaires had been returned. On or about December 1, 1969 a memo was written to all District Rangers urging them to ask those subordinates who had not completed their questionnaires to please do so. If they had lost or misplaced the questionnaire they were asked to contact the Forest Service Regional office for another questionnaire. The District Rangers were given a list of names of those subjects in their district who had not replied.

Approximately February 1, 1970 memos were written by the regional office to each subject (15) who had not responded. On February 17, 1970 the remaining personnel (8) who had not responded were contacted by phone by personnel in the regional office. As of March 1, 1970 the overall response rate for the ranger districts in the study was 91.13%, which is well within the acceptable limits set by Kerlinger (1964) of

between 80 and 90 per cent. For a breakdown of response by ranger district see Appendix I.

As the questionnaires were returned they were assigned coded identification numbers according to forest and ranger districts, subject identification number, and identification if they were a late response (later than August 31, 1969). These numbers were written on the outside of the returned envelopes. The background information and test scores from the questionnaires were entered on data sheets prior to entering on IBM punched cards.

It was necessary to check the list of supervisors given by District Rangers to insure that the supervisors fell within the definition of FMA and CC. It was also necessary to pinpoint the exact location of the supervisor within the organizational hierarchy of the ranger district for interpretation of the Leader Behavior Questionnaire, which is a description by subordinates of their supervisor's behavior. Although the subject was asked to identify his supervisor, only 44.8% responded to this question. With the subject's name, forest, and ranger district it was possible to locate the subject on the Forest Service position organization listing. Once this was accomplished the position number from the listing was matched with the position number on the ranger district organizational chart. By this method it was possible to determine the exact supervisory level of the subject and his immediate supervisor within the ranger district. This was done with all subjects, and organizational charts were constructed with name, identification number, if named supervisor and name of job of subject. It was also possible to determine that seven CCs were not rating PMAs but an inter-

mediate level of supervisor. The distribution is six in high ranger districts and one in a low ranger district.

The original design was to have twenty-four subjects per cell, four PMAs and four CCs from the twelve ranger districts (six high and six low). Due to ranger district organization it was found that two districts had only three PMAs rather than the required four, and within certain functional areas CC response was missing. The decision was made to use the mean of the scores at the supervisory level of missing response within the ranger district to fill out the cells with the required scores. The number and level for which means were used is as follows: three at the PMA level from two low and one high ranger district; four at the CC level from two low and two high ranger districts. There was only one mean score used per ranger district. A total of seven scores or 7.29% of the total scores are a reflection of means within the districts.

If there were two or more PMAs with subordinates within the functional area a random choice was made between them. If the PMA chosen had two or more subordinates a random choice was again made between them. After the final choice was made at the CC level a check was made of background information (number of subordinates) supplied by the subject to determine if the subject fell within the definition of crew chief. The random choice was made by opening the random numbers table and starting in approximately the middle and going down the column until the last digit of the identification number of either subject under consideration was found. A different page was used for each choice. The chosen subjects were then given an identification mark on the organization hierarchy charts for later reference.

A two by two design was then filled in with the chosen identification numbers from the organization charts of the ranger districts, four PMAs and four CCs, one from each functional area from the six low and six high accident ranked ranger districts. With these identification numbers as a guide the test scores were taken from the data sheets and recorded on separate sheets of paper for each scale, giving ten scales to analyze. Also compiled from the data sheets at this time were charts for education and tenure of the subjects for later normative use.

The analysis of data was accomplished with the use of the teletype terminal connected to the Oregon State University CDC 3300 computer, located in the statistic laboratory. Prepackaged program "One-Two Factor Analysis of Variance" was utilized (*ANOVA 12). In doing ten analysis of variance the idea was brought forth of the probability of getting a significant F-ratio by chance at the .05 level of significance. For example, Wilkinson (1951) presents a binomial expansion table which shows that for a set of ten analysis of variance the probability of finding four significant by chance is .001.

The Newman-Keuls (in Winer, 1962) method will be utilized in making multiple comparisons of means. The Newman-Keuls multiple comparisons test was used rather than Scheffe's method, Duncan's or individual comparisons because it offers a middle ground between being very conservative (with regard to type I error) in finding no significant differences and in finding chance differences. With individual comparisons the probability of getting a chance finding increases with each comparison. With the Duncan approach Scheffe (1959) takes issue

with the principles underlying the sampling distributions. With the Scheffe multiple comparisons method it is possible to have a significant F-ratio with an analysis of variance and in making mean comparisons have non-significant findings.

CHAPTER III

RESULTS

The significant F-ratios are shown in table I for the analysis of variance of the Job Descriptive Index, immediate supervisor scale. Significant F-ratios appear on the district variable and also an interaction of district by supervisor. The district variable refers to ranger districts rated as either low or high according to accident frequency ratios. The supervisor variable refers to principal management assistants (PMAs), the immediate subordinates of the District Ranger and crew chiefs, those full time, first level supervisors who have three or more subordinates. A Newman-Keuls multiple comparison test indicates that all means differ significantly with the exception of mean c from mean d or low accident rated CCs from high accident rated CCs.

The low accident rated PMAs described their immediate supervisor (the District Ranger) higher than any group. The CCs from low accident rated ranger districts in describing their immediate supervisor (PMAs) described them identically to high accident rated CCs. The high accident rated PMAs described their immediate supervisor (District Ranger) significantly lower than any group.

According to Kerr's (1957) GFA theory, the supervisor must maintain a work climate rich in reward opportunity, must allow freedom to set reasonably attainable goals, and receive encouragement to do his

own thinking and problem solving. From this we would hypothesize that there must be overall differences in satisfaction with the immediate supervisor in low and high accident ranger districts in the direction of low accident rated districts having significantly higher satisfaction than high accident rated districts. This hypothesis is confirmed by the significant F-ratio on the District variable. Special notice should be taken of the cell means of both low and high accident rated PMAs, and the nearly identical low and high CC cell means. The variation which accounts for the significant main effect on the district variable is occurring at the PMA level.

TABLE I

JOB DESCRIPTIVE INDEX, IMMEDIATE SUPERVISOR

Analysis of Variance

	SS	df	MS	F	P
District	42.926	1	42.292	4.448	.05*
Supervisor	3.151	1	3.151	.326	NS
DXS	47.259	1	47.159	4.897	.05*
Error	887.291	92	9.649		
Total	981.065	95			

Means and Mean Comparisons

		District		
		low	high	
Supervisor	PMA	$\bar{x}=47.92$ a	$\bar{x}=39.25$ b	$\bar{x}=43.58$
	CC	$\bar{x}=44.62$ c	$\bar{x}=44.83$ d	$\bar{x}=44.73$
		$\bar{x}=46.27$	$\bar{x}=42.04$	

Results of Multiple Comparisons

.99	b	c	d	a
b	--	5.47**	5.38**	8.66**
c		--	.21ns	3.29**
d			--	3.09**
a				--

The multiple comparisons test of means indicates that the strongest relationship exists between low and high PMAs.

The significant F-ratio is shown in table II for the analysis of variance of the Job Descriptive Index, People You Work With scale. The significant variable supervisor indicates that PMAs differ significantly from CCs. CCs in describing their co-workers described them significantly higher than did PMAs.

TABLE II

JOB DESCRIPTIVE INDEX, PEOPLE YOU WORK WITH

Analysis of Variance

	SS	df	MS	F	P
District	5.251	1	5.251	.734	NS
Supervisor	46.376	1	46.376	6.483	.05
DXS	10.414	1	10.414	.0001	NS
Error	658.112	92	7.153		
Total	709.740	95			

Means

Districts

low high

PMA	$\bar{x}=44.25$ a	$\bar{x}=42.791$ b	$\bar{x}=43.52$
Supervisor			
CC	$\bar{x}=48.66$ c	$\bar{x}=47.16$ d	$\bar{x}=47.91$
	$\bar{x}=46.45$	$\bar{x}=44.979$	

According to GFA theory, the richer the work environment in diverse reward opportunities (both economic and non-economic) the higher the level of alertness and few accidents are the result. It was hypothesized that the low accident rated ranger districts at both supervisor levels would be more satisfied with the people they work with than the high accident rated ranger districts. The data do not support this hypothesis.

From Likert's theory (1961) the hypothesis was that there would be no consistent similarity between CCs and PMAs. There is support for this hypothesis; there were significant differences between supervisory levels. The CCs in both low and high ranger districts described the people they worked with in significantly higher terms than the PMAs in low and high accident rated ranger districts.

The significant F-ratio is shown in table III for the analysis of variance of the Leader Behavior Questionnaire, consideration scale. The district variable is indicated as being significant, which indicates significant differences between low and high accident rated ranger districts. The low PMAs and CCs described their immediate supervisor as being significantly higher on the consideration scale than do both high PMAs and CCs.

TABLE III

LEADER BEHAVIOR QUESTIONNAIRE, CONSIDERATION

Analysis of Variance

	SS	df	MS	F	P
District	91.884	1	91.884	6.457	.05
Supervisor	3.876	1	3.876	.272	NS
DXS	23.751	1	23.751	1.669	NS
Error	1309.137	92	14.229		
Total	1428.648	95			

		Means		
		District		
		low	high	
Supervisor	PMA	$\bar{x}=55.29$	$\bar{x}=45.95$	$\bar{x}=50.65$
	CC	$\bar{x}=53.41$	$\bar{x}=50.37$	$\bar{x}=51.89$
		$\bar{x}=54.35$	$\bar{x}=48.16$	

According to GFA theory (1957) the supervisor must maintain work climate rich in reward opportunity, must allow freedom to set reasonably attainable goals, and receive encouragement to do his thinking and problem solving. Consideration is defined as a job relationship characterized by mutual trust, respect for subordinates' ideas and consideration of feelings. From theory the hypothesis is that significant overall differences in satisfaction with the immediate supervisor in terms of consideration will occur between low and high accident rated ranger districts. This hypothesis is supported with a main effects significant difference on the district variable in the predicted direction of higher consideration for low accident rated ranger districts.

The significant F-ratio for the analysis of variance of the Choice-Dilemma Questionnaire is shown in Table IV. With this scale the significant variable is supervisory level which indicates that sig-

nificant variable is supervisory level which indicates that significant differences exist between PMAs and CCs. To aid in interpretation of results some explanation of scoring is necessary. A low mean indicates that the subjects are willing to take more risks in the hypothetical situations posed in the questionnaire; a high mean indicates that the subject is willing to take very little risk. The overall means of main effects show that the PMAs have mean scores significantly lower (high risk takers) than do CCs (low risk takers).

TABLE IV
CHOICE DILEMMA QUESTIONNAIRE

Analysis of Variance

	SS	df	MS	F	P
District	34.844	1	34.844	1.874	NS
Supervisor	81.084	1	81.084	4.357	.05
DXS	15.759	1	15.759	.846	NS
Error	1711.995	92	18.608		
Total	1843.723	95			

Means

		District		
		low	high	
PMA		$\bar{x}=71.33$ a	$\bar{x}=72.58$ b	$\bar{x}=71.95$
Supervisor				
CC		$\bar{x}=74.58$ c	$\bar{x}=80.95$ d	$\bar{x}=77.77$
		$\bar{x}=72.95$	$\bar{x}=76.77$	

There is no support for Kerr's GFA theory (1957) with the Choice Dilemma Scale. The results show no difference between low and high accident rated ranger districts. GFA theory would state that the

setting of reasonably attainable goals and the subjects being able to exert influence on his environment will result in high quality, low accident work performance. The hypothesis was that low accident rated ranger districts at both supervisory levels would be moderate risk takers, and that high accident rated ranger districts at both supervisory levels would be high risk takers. A comparison of the overall means on the low and high district variables indicate that the low CCs and PMAs have no significant difference than the high CCs and PMAs.

The results of the analysis of variance for the Job Descriptive Index, Pay, are presented in table V. There are no significant relationships, although on the supervisor variable $F=3.73$ approaches the tabled value of $F_{.95}(1,92)$ of 3.95.

TABLE V

JOB DESCRIPTIVE INDEX, PAY

Analysis of Variance

	SS	df	MS	F	P
District	6.337	1	6.337	1.303	NS
Supervisor	18.150	1	18.150	3.734	NS
DXS	4.816	1	4.816	.9910	NS
Error	447.158	92	4.860		
Total	476.462	95			

Means

District

low

high

Supervisor	PMA	$\bar{x}=15.54$ a	$\bar{x}=18.58$ b	$\bar{x}=17.06$
	CC	$\bar{x}=14.20$ c	$\bar{x}=14.41$ d	$\bar{x}=14.31$
		$\bar{x}=14.87$	$\bar{x}=16.50$	

According to GFA theory the richer the work climate is in diverse (economic and non-economic) reward opportunities the higher the level of alertness equaling lower accident frequency. The hypothesis is that low accident rated ranger districts will have significantly higher satisfaction with pay than high accident rated ranger districts. This hypothesis was not supported.

The results of the analysis of variance for the Job Descriptive Index, Work, are presented in table VI. There are no significant relationships.

TABLE VI

JOB DESCRIPTIVE INDEX, WORK

Analysis of Variance

	SS	df	MS	F	P
District	1.041	1	1.041	.018	NS
Supervisor	7.014	1	7.014	.125	NS
DXS	12.604	1	12.604	2.237	NS
Error	513.150	92	5.632		
Total	531.562	95			

Mean Table

		District		
		low	high	
Supervisor	PMA	$\bar{x}=41.91$ a	$\bar{x}=39.41$ b	$\bar{x}=40.66$
	CC	$\bar{x}=40.16$ c	$\bar{x}=42.15$ d	$\bar{x}=41.20$
		$\bar{x}=41.04$	$\bar{x}=40.83$	

According to GFA theory the low accident rated ranger districts would have higher satisfaction with their work than high accident rated

ranger districts, due to the maintenance of a higher reward situation within the districts.

The results of the analysis of variance for the Job Descriptive Index, Promotion, are presented in table VII. There are no significant relationships.

TABLE VII
JOB DESCRIPTIVE INDEX, PROMOTION

Analysis of Variance					
	SS	df	MS	F	P
District	4.537	1	4.537	.7171	NS
Supervisor	3.504	1	3.504	.5538	NS
DXS	.8166	1	.8166	.1291	NS
Error	582.125	92	6.327		
Total	590.983	95			

Cell Means

		District		
		low	high	
Supervisor	PMA	$\bar{x}=15.66$ a	$\bar{x}=13.70$ b	$\bar{x}=14.68$
	CC	$\bar{x}=16.29$ c	$\bar{x}=15.50$ d	$\bar{x}=15.89$
		$\bar{x}=15.97$	$\bar{x}=14.60$	

According to GFA theory the richer the work climate is in diverse reward opportunity (economic and non-economic) the higher the level of alertness and less accidents. The hypothesis from this would be that low accident rated ranger districts at both levels of supervision would experience higher satisfaction with promotion than high accident rated ranger districts. There are no significant differences, and the hypothesis is not supported.

The results of the analysis of variance for the Leader Behavior Questionnaire, Structure, are presented in table VIII. There are no significant differences.

TABLE VIII
LEADER BEHAVIOR QUESTIONNAIRE, STRUCTURE

Analysis of Variance					
	SS	df	MS	F	P
District	5.704	1	5.704	.467	NS
Supervisor	2.604	1	2.604	.213	NS
DXS	17.066	1	17.066	1.397	NS
Error	1123.625	91	12.213		
Total	1149.00	95			

Cell Means

		District		
		low	high	
Supervisor	PMA	$\bar{x}=42.87$ a	$\bar{x}=47.08$ b	$\bar{x}=44.97$
	CC	$\bar{x}=46.58$ c	$\bar{x}=45.45$ d	$\bar{x}=46.87$
		$\bar{x}=44.72$	$\bar{x}=46.27$	

According to GFA theory the work climate must encourage the individual supervisor to participate, solve problems and feel free to exercise influence over his environment. The hypothesis was that low accident rated ranger districts at both levels of supervision would be significantly less structured in the rating of their immediate supervisor than high accident rated ranger districts at both levels of supervision. The hypothesis was not supported.

The results of the analysis of variance Leader Opinion Questionnaire, Structure, are presented in table IX. There are no significant relationships.

TABLE IX

LEADER OPINION QUESTIONNAIRE, STRUCTURE

Analysis of Variance

	SS	df	MS	F	P
District	.876	1	.876	.118	NS
Supervisor	5.859	1	5.859	.790	NS
DXS	2.604	1	2.604	.003	NS
Error	682.337	92	7.416		
Total	689.098	95			

Means

District
low high

PMA	$\bar{x}=47.41$ a	$\bar{x}=48.12$ b	$\bar{x}=47.77$
Supervisor			
CC	$\bar{x}=45.95$ c	$\bar{x}=46.45$ d	$\bar{x}=46.20$
	$\bar{x}=46.68$	$\bar{x}=47.29$	

GFA theory states that the work climate must encourage the individual to participate and feel free to set his own goals and exercise some influence over his environment. The supervisor who is highly structured will severely limit the amount that an individual is allowed to set his own goals. The result will be a lower level of alertness and the quality of work will decline, resulting in accidents. The hypothesis is that low accident rated ranger districts will have significantly lower structure scores than the high accident rated ranger

district supervisors. The hypothesis is not supported.

The results of the analysis of variance for the Leader Opinion Questionnaire, Consideration, are presented in table X. There are no significant relationships.

TABLE X

LEADER OPINION QUESTIONNAIRE, CONSIDERATION

Analysis of Variance

	SS	df	MS	F	P
District	8.437	1	8.437	1.271	NS
Supervisor	4.816	1	4.816	.725	NS
DXS	4.816	1	4.816	.725	NS
Error	610.625	92	6.638		
Total	628.695	95			

Means

		District		
		low	high	
Supervisor	FMA	$\bar{x}=52.25$ a	$\bar{x}=55.54$ b	$\bar{x}=53.89$
	CC	$\bar{x}=55.08$ c	$\bar{x}=55.54$ d	$\bar{x}=55.31$
		$\bar{x}=53.66$	$\bar{x}=55.54$	

GFA theory states that the work climate must encourage the worker to do his own thinking, make constructive suggestions, set reasonably attainable goals and exercise over his environment. The hypothesis is that low accident rated ranger districts personnel will have significantly higher consideration scores than high accident rated ranger district personnel. The hypothesis is not supported.

CHAPTER IV

SUMMARY

Significant differences were found on four of the ten scales employed in this study. There are two significant differences on the district variable and two significant differences on the supervisor variable.

There are two significant differences on the district variable which could be interpreted in support of GFA theory. GFA theory would predict high satisfaction with the immediate supervisor in low accident rated ranger districts and significantly lower satisfaction in high accident rated districts. These significant differences occur on the Job Descriptive Index, immediate supervisor scale and the Leader Behavior Questionnaire, consideration scales. Both instruments describe the attitudes toward the immediate supervisor, with principal management assistants describing their District Ranger and crew chiefs describing the principal management assistants. Although the prediction is supported from GFA theory the probability of getting two significant F-ratios in a series of ten is .086, which does not lend firm support to GFA theory (Wilkinson, 1951).

There are two significant differences on the supervisor variable which could be interpreted in support of Likert's theory of dissimilarity of attitudes between supervisory levels. Likert's prediction was that there would be no consistent similarity between supervisory levels. The

significant differences occur on the Job Descriptive Index, people you work with scale and the Choice Dilemma Questionnaire. At the PMA level the supervisors are significantly less satisfied with their co-workers than the CCs. On the Choice Dilemma Questionnaire the PMA level of supervision were significantly higher risk takers than the CCs. Although the two scales are in support of Likert's theory, again the probability of getting two significant F-ratios in a series of ten is .086, which does not level firm support to Likert's theory.

Overall the GFA predictions were in the predicted direction seven times for the ten scales. A sign test (Wilcoxon, 1949) for directionality ($p=.5$, $n=10$) indicates that P is equal to approximately .172. Neither the sign test nor the analysis of variance support GFA theory.

There are six non-significant scales which do not support GFA or Likert's theory (table XI). Three of the non-significant scales are concerned primarily with reward; these are the Job Descriptive Index, pay, promotion, and work. GFA theory predicted that a work climate rich in reward (both economic and non-economic) was related to accident frequency. There was no support for this hypothesis on the three scales. Likert's theory (1961) predicted no consistent relationship between PMAs and CCs. There was no support for this hypothesis from the three scales.

The Leader Behavior Questionnaire, structure and the Leader Opinion Questionnaire, structure and consideration are the remaining three scales. All three scales are concerned with leadership style. The Leader Behavior Questionnaire is concerned with a rating of your

TABLE XI
SUMMARY OF RESULTS

	District	Super.	DXS
J.D.I., Immed. Super.	.05	NS	.05
J.D.I., Per. Wk. With	NS	.05	NS
L.B.Q. Consideration	.05	NS	NS
Choice Dilemma	NS	.05	NS
J.D.I., Pay	NS	NS	NS
J.D.I., Work	NS	NS	NS
J.D.I., Promotion	NS	NS	NS
L.B.Q., Structure	NS	NS	NS
L.O.Q., Structure	NS	NS	NS
L.O.Q., Consideration	NS	NS	NS

immediate supervisor on the structure scale. The Leader Opinion Questionnaire is a self-description of how you as a supervisor lead on the dimensions of structure and consideration. According to GFA theory the low accident rated ranger districts would be significantly lower on structure and higher on consideration than accident rated high ranger districts. G.F.A. theory was not supported by these three scales. According to Likert (1961) there would be no consistent similarity or significant difference between supervisor attitudes. This hypothesis was not supported on the three scales.

CHAPTER V

DISCUSSION

The present study was based on the simple idea that attitudes are related to accidents. It was hypothesized that groups classified on the basis of accident frequency ratios, when given attitude tests, would show significant differences in attitudes. Although the results are not as significant as hoped from theory, there is a pattern for two scales.

The overall pattern that emerges independent of theory is one that indicates that satisfaction with District Rangers by their subordinates (FMAs) differs between low and high accident rated ranger districts. This was indicated by the Job Descriptive Index, immediate supervisor scale and the Leader Behavior Questionnaire, consideration. Although there were significant differences between districts rated high and low, the most significant differences occurred at the FMA level on both scales.

The prediction from theory was that there would be no consistent relationship between supervisory levels. There were two scales which gave significant results on this variable, the Job Descriptive Index, people you work with scale and Choice Dilemma Questionnaire.

The present findings lend some support to the claim that different organizational levels have differential effects on the subjects in their jurisdiction. It was thought that the first line supervisor (CC)

would exhibit the most significant difference in attitudes, and this level of supervision would be seen as being the locus of influence. There is no support for this thinking, instead the one clearcut finding is that the locus of influence appears at the District Ranger level of supervision.

Additional variables which could have influenced the result are the unreliability of the accident frequency ratios, the subjects neglecting or refusing to identify their immediate supervisor, a late response rate, and too broad a unit of study in using ranger districts. Additional analysis should be carried out on the latter three variables to determine if they have any influence on the significant results of the four scales.

The correlation of the accident frequency ratios for 1967 and 1968 of all ranger districts within the forests gave an $r=.395$, which indicates the overall lack of stability of accident frequency ratios. It should be remembered that the mean of the 1967 and 1968 accident frequency ratio is used as a classification device and that only those districts at the extremes of the distribution (low and high) were used in this study.

The distribution of subjects who neglected to identify their immediate supervisor is shown in table XII.

A total of 42% did not identify their supervisor. From inspection of this table it appears that there may be a canceling of effects from one coll to another.

A total of 34.8% of the subjects submitted late responses (after August 31, 1969), 7.86% low PMAs, 14.6% high PMAs, 6.74% low CCs and 5.61% high CCs.

TABLE XII

DISTRIBUTION OF SUBJECTS WHO DID NOT
IDENTIFY THEIR SUPERVISORS

		District	
		low	high
PMA		50% did identify 50% did not	57% did identify 43% did not
Super.			
CC		63% did identify 37% did not	63% did identify 37% did not

The present data should be analyzed to determine if the ranger district variable is too broad a group to study. The suggestion has been made that perhaps one crew in a certain functional area may be accounting for a high accident frequency ratio for their ranger district. The use of the district variable may be obscuring the issue of attitudes which are related to accidents. The functional areas can be analyzed to see if certain crews will conform to the predictions from GFA theory.

Further replication research could be carried out to determine if the results (significant) generalize in other periods of accident frequency. For example, two years from now replicating this study with the added possibility of administering the significant scales to the lowest level workers to arrive at a rating on these scales for the crew chiefs. The data from this study do not include a rating of the CC by their subordinates. Replication of this study in ranger districts which are not predominately heavy timber, which is the case

with this study, should be carried out to determine if the results of this study will hold for districts which are not predominately timber.

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APPENDIX A

VARIANCE ATTRIBUTED TO ACCIDENT THEORIES

Accident Proneness	1% to 15%
Individual GFA	30% to 40%
Adjustment Stress	45% to 60%

APPENDIX B

INSTRUCTIONS FOR USE'S SUPERVISORY AND MANAGEMENT PERSONNEL

This packet of questionnaires and other materials is part of a special study being conducted on your Forest. There are six other Forests who are also cooperating in this study. The purpose of this study is to identify, if possible, any aspects of managerial style or personal behavior which might explain a significant number of accidents. There are a number of plausible theories which have been used to explain the frequency of accidents. In large part, a major goal of this study will be to determine if such rather commonly held explanations can be verified by such a systematic research project.

To insure maximum honesty and cooperation, it is a common practice, when administering questionnaires to employees, to have the employee return the questionnaire without identifying himself by name. Because of the design for this project, such complete anonymity is not possible. Therefore, we are asking that you identify yourself by name and by position within the Forest organization. However, we will not

report the answers provided by you to anyone in the Forest or regional organization. Only group totals and group summaries will be reported. Enclosed you will find an addressed and franked envelope which will go directly to Dr. Milton K. Davis at Portland State University. Obviously, this method bypasses the internal communication system of the Forest Service.

Your specific instructions for completing this portion of the study are as follows:

1. Take the questionnaires one at a time.
2. Read the instructions provided on each questionnaire and then complete it.
3. Please return all of the completed questionnaires at the same time. That is, do not send in a portion of completed questionnaires one time and then mail the remainder later on.
4. When you have completed all questionnaires, place them in the enclosed envelope and mail them to Portland State University.

Thank you very much for your cooperation.

APPENDIX C

LENGTH OF SERVICE OF DISTRICT RANGERS

<u>Ranger Dist.</u>	<u>Dist. Ranger</u>	<u>Length of Service</u>
Blue River	M. Kerrich	1/68 to the present
Rigdon	M. Lysne	prior to 1967 to the present
Baker River	W. Knechtel	prior to 1967 to the present
Darrington	R. Taylor	prior to 1967 to the present
Smith River	R. Long	prior to 1967 to the present
Alsea	J. Overbay	6/67 to the present
Prospect	I. Smith	8/68 to the present
Applegate	R. Lenthauser	prior to 1967 to the present
Galice	D. Wood	prior to 1967 to the present
Illinois Valley	G. Ohrmund	prior to 1967 to the present
Mt. Adams	R. Starny	prior to 1967 to the present
St. Helens	R. Coon	prior to 1967 to the present

APPENDIX D

COMPARISON OF LOST-TIME ACCIDENT FREQUENCY RATIO CLASSIFICATION WITH
ALL-INJURY* ACCIDENT FREQUENCY RATIO CLASSIFICATION FOR FORESTS

	a*		rank	b*	rank	c*	rank	
previous								
"low" rated	(20)	26.7	1	53.8	4	39	1	dropped "low" forests
forests	(26)	71.5	5	82.4	7	76.5	6	
(lost-time)	(22)	62.1	3	53.5	3	57.5	3	
"medium"								
rated	(25)	49.51	2	44.82	1	46	2	"medium" forests
forests	(24)	76.03	6	47.0	2	61.5	4	
(lost-time)								
"high" rated	(21)	101.89	7	57.7	5	79	7	"high" forests
forests	(23)	62.7	4	80.2	6	71	5	
(lost-time)								

a* 1967 all-injury frequency ratios

b* 1968 all-injury freq. ratios

c* 1967-68 all-injury freq. ratios

The Forests were originally classified according to lost-time accidents; then it was decided that a more sensitive measure of accidents was needed. When going from the Forest level to the Ranger level with lost time accidents it was impossible to get a clear rating of those Ranger Districts low or high because it was usually the case of having one or perhaps two lost-time accidents each year. The 2 year average of all injury accident frequency ratios were used at the Forest level and at the Ranger District level for rating purposes.

*Does not include motor vehicle accidents.

APPENDIX E

ONE-WAY ANALYSIS OF VARIANCE FOR LOW, MEDIUM, AND HIGH

ACCIDENT RATED FORESTS

(Accident frequency ratios used were 1967-68 averages for all Ranger Districts within the respective forests.)

	SS	DF	MS	F	P
Treatment	3,111.8	2	1,555.90	.0031	ns
Error	1,469,096.7	30	1,469,096.90		

APPENDIX F

ONE-WAY ANALYSIS OF VARIANCE FOR LOW AND HIGH ACCIDENT

RANGER DISTRICTS

	SS	DF	MS	F	P
Treatment	26,885	1	26,885	15.44	.01
Error	17,418.6	10	174,186		

APPENDIX G

ALL INJURY ACCIDENT FREQUENCY RATIOS FOR RANGER DISTRICTS

WITH THE AVERAGE OF 1967-68

Low Ranger Districts

Willamette N. F.	Suislaw N. F.	Rogue River N. F.
Blue River R. D.	Alsea R. D.	Prospect R. D.
1967- 9.35	1967-70.24	1967-26.12
1968- <u>48.84</u>	1968- <u>60.24</u>	1968- <u>33.90</u>
57.84 average=28.92	80.66=40.33	60.02=30.01
Gifford-Pinchot N. F.	Mt. Baker N. F.	Suislaw N. F.
Mt. Adams R. D.	Darrington R. D.	Hebo R. D.
1967-38.02	1967-95.50	1967-47.03
1968- <u>23.27</u>	1968- <u>10.40</u>	1968- <u>47.03</u>
61.29=30.64	105.90=52.93	94.06=47.03

High Ranger Districts

Willamette N. F.	Suislaw N. F.	Rogue River N. F.
Rigdon R. D.	Smith River R. D.	Applegate R. D.
1967-124.60	1967-88.58	1967-78.24
1968- <u>63.92</u>	1968- <u>127.83</u>	1968- <u>135.15</u>
198.52=94.26	216.41=108.20	213.15=106.5
Gifford-Pinchot N. F.	Mt. Baker N. F.	Siskiyou N. F.
St. Helens R. D.	Baker R. D.	Galie R. D.
1967-73.92	1967-260.23	1967-235.5
1968- <u>58.83</u>	1968- <u>187.06</u>	1968- <u>95.9</u>
132.75=66.37	447.31=223.65	331.4=165.7

APPENDIX H

ORGANIZATION CHART FOR FORESTS AND RANGER DISTRICTS

APPENDIX I

RETURN RATE BY RANGER DISTRICTS

DISTRICT	SENT	RETURNED	PERCENT
Blue River-Low	15	13	86.6%
Rigdon-High	16	13	81.2%
Galice-High	13	12	92.3%
Applegate-High	20	18	90.0%
Prospect-Low	13	11	84.6%
Baker River-High	13	13	100.00%
Darrington-Low	13	10	76.9%
St. Helens-High	15	13	86.6%
Mt. Adams-Low	15	13	86.6%
Hebo-Low	11	9	81.8%
Alsea-Low	10	10	100.0%
Smith River-High	<u>15</u>	<u>13</u>	86.6%
TOTALS	169	158	OVERALL RETURN RATE
			91.1%