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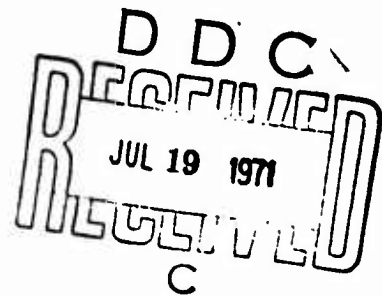
**SOCIAL AND PSYCHOLOGICAL FACTORS
IN HUMAN STRESS**

**Final Report of AFOSR Grant
~~AF 1161-66, AF 1161-67, and AF 1161-67a~~
(June 66-May 71)**

**J. E. McGrath,
Principal Investigator**

June, 1971

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15. ABSTRACT

This final report describes studies completed or in progress within all three phases of a program of research on social and psychological factors in human stress. It lists six major substantive propositions and three key sets of methodological issues which were induced from integrative studies of Phase I. These nine issues provide the guiding concepts for a set of six empirical and theoretical studies initiated in Phase II. Each study is described in summary form. Phase III focussed on a field test of a model of stress, a reformulation of the model based on results of the field study, and several further studies designed to test the reformulated model. In all, 16 books, chapters, journal articles and reports were produced as part of this research program; those 16 publications are listed.

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Stress Social Interaction Task Environment Reinforcement Experience Cognitive mediation Convergent measures Temporal factors Natural Setting Inverted U-curve Response patterning						

Social and Psychological Factors in Human Stress

This is the final report of a program of research on social-psychological factors in human stress. The program was conducted under the sponsorship of the Air Force Office of Scientific Research, under AFOSR grants 1161-66, 1161-67 and 1131-67a (J. E. McGrath, principal investigator) in the period from June 1966 through 31 May 1971. The program was conducted in three phases. Results of phases I and II were described in an earlier interim report of the program, in June 1969. The remainder of the report summarizes the main efforts of each of these phases, and lists the main publications resulting from work supported under this program.

PHASE I (June 66-May 67)

Phase I of the study called for an integrative review of past research bearing on social and psychological factors in human stress. One crucial part of the Phase I was the conduct of a three-day working conference at which 12 researchers, knowledgeable in various aspects of social-psychological research and theory, presented and discussed theoretical, substantive and methodological issues. Results of the integrative study of Phase I, and the papers contributed by the conference participants, are presented in a book. (See references 10 and 11.)

The contents of that book, indicating the range and depth of coverage, are listed below:

TITLE: Social and Psychological Factors in Stress

EDITOR: Joseph E. McGrath

PUBLISHER: Holt, Rinehart and Winston, Incorporated

PUBLICATION DATE: 1970

CHAPTER 1: Introduction - J. E. McGRATH

CHAPTER 2: A Conceptual Formulation for Research on Stress - J. E. McGRATH

**CHAPTER 3: Major Substantive Issues: Time, Setting, and the Coping Process.
J. E. McGRATH**

CHAPTER 4: Major Methodological Issues - J. E. McGRATH

**CHAPTER 5: Settings, Measures, and Themes: An Integrative Review of some
Research on Social-Psychological Factors in Stress.
J. E. McGRATH**

**CHAPTER 6: Some Propositions Toward a Researchable Conceptualization
of Stress - ROBERT L. KAHN**

**CHAPTER 7: Some Problems in Developing a Social Psychology of Adaptation
to Stress - DAVID MECHANIC**

CHAPTER 8: Psychological Research Needs on the Problems of Human Stress

JOSEPH WEITZ

CHAPTER 9: On the Nature of Stress - S. B. SELLS

CHAPTER 10: Strategies for Controlling Stress in Interpersonal Situations -

IVAN D. STEINER

CHAPTER 11: Interpersonal Stress in Isolated Groups - WILLIAM HAYTHORN

CHAPTER 12: The Ecology of Interpersonal Relationships: A Classification

System and Conceptual Model - IRWIN ALTMAN AND EVELYN

E. LETT

CHAPTER 13: Tasks and Task Performance in Research on Stress - J. RICHARD

HACKMAN

CHAPTER 14: Status and Conflict: Two Themes in the Study of Stress -

ROBERT L. KAHN AND JOHN R. P. FRENCH, Jr.

CHAPTER 15: Community Disaster and System Stress: A Sociological Per-

spective - J. EUGENE HAAS AND THOMAS E. DRABEK

CHAPTER 16: The "Ess" in Stress: Some Conceptual and Methodological

Problems - KARL WEICK

CHAPTER 17: Some Strategic Considerations for Future Research on Social-

Psychological Stress - J. E. McGRATH

The integrative study and the conference of Phase I led to the emergence of a series of key substantive and methodological issues which are crucial for future studies of social-psychological stress.

The key substantive issues, greatly simplified, are:

- (1) The importance of cognitive appraisal of the situation in determining psychological (as distinct from physiological) stress; and, in general, the importance of cognitive mediation in the occurrence of stress and in reactions to stress.

- (2) The role of past experience as a modifier of stress.
- (3) The role of past success or failure, or more generally, of reinforcement, as a modifier of stress.
- (4) The general hypothesis that there is a non-monotonic relationship (the inverted U-curve) between stress (in the sense of arousal) and performance.
- (5) The crucial role of social-interaction, in both intensifying and reducing certain aspects of stress.
- (c) The crucial role of task and environmental features of the situation, in both intensifying and reducing certain aspects of stress.

The key methodological issues, again oversimplified, are:

- (1) The problem of determining convergent and discriminant validity, including: (a) the need for multiple, independent measures; (b) the need for calibration of both "stimuli" and "response" aspects of stress; (c) the need for identifying sources of method variance; and (d) the need for analysis of differential response patterning.
- (2) The importance of various temporal aspects in stress, including: (a) the need for longitudinal studies and for measurement of stress at multiple points in time; (b) the importance of the timing of onset and cessation of stress, and duration of stress conditions; and (c) the need for study of time as a medium within which coping behavior takes place.
- (3) The importance of and need for studies of stress in natural settings, so that non-reactive measures can be obtained, and so that subjects are operating under conditions of "real" motivation and "real" stress.

These six substantive propositions and three clusters of methodological problems, formed the conceptual guides for the second, developmental phase of the program.

PHASE II (June 67-May 69)

The objective of Phase II was to develop models and methods appropriate for research on social-psychological factors in human stress. In Phase II, we conducted six studies, each of which focussed on one or more of the six substantive issues and/or one or more of the three clusters of methodological issues. Brief descriptions of the six studies of Phase II are given below.

Study #1: PERCEIVED FREEDOM (Steiner)

One of the intriguing features of the stress literature is the crucial role that "cognitive appraisal"--i. e., the individual's perception or interpretation of the situation--plays in determining (1) the degree of psychological stress experienced, and (2) reaction to stress. It is clear that "one man's threat is another man's challenge."

Steiner conducted a broadly integrative study of theoretical and research literature; developed a concise, formal statement of the inter-relations among a series of factors (costs, rewards, decision and outcome freedom) in determining the individual's perceived freedom or perceived threat; and applied this theoretical formulation to summarize a broad range of research findings. This conceptual statement deals with and ties together all six of the substantive propositions. (See reference 14.) Kauffmann conducted an empirical study to test portions of that theoretical formulation. (See reference 5.)

Study #2: EFFECTS OF COUNTER-ATTITUDINAL ROLES (Steiner and Darroch)

One aspect of social-psychological stress which we have explored is the potentially stressful effects of "public" espousal of counter-attitudinal views. Most past studies of counter-attitudinal roles have focussed on the attitude-change effects of such situations. Steiner and Darroch conducted a study of the stressful effects of public espousal of counter-attitudinal views as they influence the quality of the role performance, and how subjective stress, quality of performance and attitude change relate to one another. (See reference 15.)

Study #3: RISK-TAKING BEHAVIORS (Weidemann)

One class of potentially stressful situations, which has been studied more or less extensively in recent years, involves decisions or choice behavior. Weidemann conducted a study in this area using the so-called "risky-shift" phenomenon. This study explored the relationship between risk-taking choices and several factors pertinent to the overall stress problem: (1) the nature of the issue (the "value" hypothesis), and of the rewards and costs involved; (2) effects of social pressure through feedback processes (the "social comparison" hypothesis); (3) effects of experience or exposure (the "familiarization" hypothesis); and (4) effects of social pressure through direct interpersonal interaction (the "group risky-shift" hypothesis).

This study thus dealt with several of the guiding substantive propositions: cognitive mediation, effects of experience, effects of reward or feedback, social interaction and task-environment effects. Results show that all four of these factors play a part, interactively, in accounting for the so-called "risky-shift" phenomenon. (See reference 1.)

Study #4: STUDY OF RESPONSE PATTERNING (Blaylock)

One of the key methodological issues identified in Phase I has to do with the need for development of multiple, convergent measures of stress. However, Lazarus has argued for investigation of differential response patterns, along with the study of convergent response measures (see Lazarus' chapter in Appley and Trumbull, 1957). Lacey (see Lacey's chapter in Appley and Trumbull, 1957) also has urged study of differential stress-reaction patterns, and has presented evidence that certain differential response patterns (e. g., heart rate increase and GSR increase in pattern #1; heart rate decrease and GSR increase in pattern #2) occur as a function of different types of tasks, (e. g. mental work vs. intake of information). Lacey refers to this as the "fractionation hypothesis." Others (notably Campos and Johnson, 1955, 1957) have argued that Lacey's findings can be accounted for more parsimoniously in terms of task demands for verbalization, and they present evidence to support that claim.

Blaylock conducted a study to test both the Lacey and the Campos and Johnson explanations, and hence to determine the extent to which these physiological indices of stress show convergence, and/or differential response patterning, as a function of different task and situational conditions. In terms of the guiding substantive and methodological issues, this study involves task/environmental effects, and convergent and discriminant response patterns. Results tend to support the Lacey "fractionation hypothesis" but suggest some limiting conditions for its applicability. (See reference 1.)

Study #5: SOCIAL INTERACTION AND TASK PERFORMANCE (Rosemary Lowe and McGrath)

One of the substantive generalizations emerging from the integrative study of Phase I is that presence and interaction of others (as compared to social isolation) is both a resource in the individual's efforts to cope with stressful situations, and, at the same time, an additional source of potential stress on the individual. On the other hand, one of the unanswered, though much studied, questions in the small group research area has to do with how individuals combine their skills and resources to accomplish tasks in concert, and how social-interaction processes operate to affect such group task performances. In earlier research, Steiner (1950) specified several models for combining individual's task capabilities to estimate potential group productivity, and hypothesized that certain interaction processes (namely, motivation and coordination) operated to reduce actual group productivity below potential group productivity.

Rosemary Lowe and McGrath conducted a study to explore these models. More specifically, the study explores (1) the usefulness of several models (conjunctive, disjunctive, additive) in predicting how individuals combine their task-skills when called upon to perform tasks as a group; (2) how these relationships vary for different dimensions of task performance (e. g. , quality, originality, time to complete), and for different types of tasks (production, discussion, problem-solving); and (3) how these relationships are mediated by indices of motivation and coordination. This study also includes measures of interaction process during task performance, which can be used to explore how social-interactive processes (communication, influence, affect) operate to aid or hinder performance of group tasks.

If we are to explore how social-interactive processes operate to facilitate and hinder task performance under stress conditions, we must first determine how these social-interactive processes operate for task performance under baseline, or non-stress conditions. This study deals with three of the substantive propositions (effects of experience, effects of social-interaction and task-environmental effects), and with one methodological area (convergent-discriminant response patterns). (See reference 3.) In a related study, Kent and McGrath used the same tasks to estimate the relative effects of task types and group composition on several aspects of group performance. Results show very strong effects of differences in task types, and relatively weak effects of differences in group composition. (See reference 6.)

Study #3: GROUP PROCESS AND TASK PERFORMANCE AS A FUNCTION OF
TASK, TIME AND STRESS (Stapert and McGrath)

One of the most crucial needs in the area of social-psychological stress is for comprehensive and systematic sets of data, involving measurement of important "traits" by multiple, independent methods, on multiple, time-ordered occasions, in relation to multiple levels of "stress" conditions which can be compared or related to one another. Stapert and McGrath conducted a study which was an attempt to collect such a systematic body of data.

Specifically, the study involved measurement of a trilogy of key group process traits (activity, influence, attraction), by each of five different methods (self and peer ratings, observer ratings, photographic records, and paper and pencil "test"). Each of 18 four-man groups, of three different task types, worked for eight hours. Task load (rate of required performance) was varied from "baseline" to "overload" to "underload." Measurements were taken at 15-minute intervals during the performance of each of a series of comparable tasks.

The main focus of the study was on development of a methodology for systematic collection and treatment of multi-trait, multi-method, multi-occasion sets of data, which can subsequently be applied in a broad range of situations involving stress, including "natural settings." But the study also permitted investigation of a number of important substantive issues, such as: (a) differences in social-interaction processes under varying conditions of stress (i. e. task-load); (b) convergence and discrimination of multiple measures of group process and task performance; (c) analysis of temporal patterns in group process and in task performance measures, under varying conditions of (task-load) stress.

The study thus involves four of the substantive propositions (effect of experience, the U-shaped relation of stress and performance, social-interaction effects and task-environmental effects), as well as two of the three key methodological issues (convergent and differential response patterns, and temporal factors). (See reference 13.) In a related study, Gwynn measured the effects of shifts in organizational arrangements (i. e. distance of persons from one another and from key facilities) on interaction patterns of members of a large department of a university. (See reference 4.)

PHASE III (June 69-May 71)

The objective of Phase III was to test, revise and extend our model of social-psychological stress. The central effort of the Phase III program was a large scale field experiment, designed to test a theoretical model which incorporated all six of the substantive issues, under real-life conditions which would take into account the main methodological issues. A summary of the rationale, procedures and results of that study are given below:

Study #7: COPING WITH STRESS IN NATURAL SETTINGS (Randall Lowe and McGrath)

One of the weaknesses of much of the stress literature is that studies done in the laboratory (as opposed to field or natural setting) place special limitations on the interpretability of results. First of all, measures in laboratory studies are reactive, since subjects know they are being studied. Furthermore, in laboratory settings subjects are not operating under "real" stress conditions, with real consequences for their lives, and hence may not be operating under "real" motivational conditions. On the other hand, stress studies done in field settings have often been done poorly, in both substantive and methodological senses. They have tended to be case studies of various sorts, have been done with little conceptual focus, and have used weak and imprecise techniques of measurement.

To deal with both of these sets of weaknesses simultaneously requires systematic, conceptually-based, "nomothetic" studies, using reliable, unobtrusive, and multi-method measures, but carried out in natural settings wherein the participants are involved, motivated and undergoing stress independent of the experimenter and his purposes. Randall Lowe and McGrath conducted a study which is an attempt to meet those criteria. (See reference 9.)

Specifically, the study involved measurement of stress and performance involved in Little League baseball. We obtained physiological (heart rate and breathing rate) and behavioral measures of stress, for each batter of all teams in each game of a four-team league for an entire season (36 game round-robin schedule). In addition, we obtained indices of the "objective" stress of the at-bat situation (in terms of closeness of game, outs, inning, base runners) and of the particular game (in terms of league standings, games remaining, and

potential of opposing team); observer ratings of batter performance (as distinguished from its outcome), and game records of outcome (out, hit, base runners advanced, etc.) of each man's at bat. We also got indices of player experience, and of past success and failure. From these data, we set out to test a theoretical model based on the substantive principles derived from Phases I and II of the program. Specifically the theoretical formulation proposed that:

- (1) Experienced stress (as indicated by the physiological measures) is a direct function of objective demand of the situation (as indexed by an "at-bat'criticalness" score and a "game-criticalness" score)
- (2) The relationship is modified by past experience (i. e. , previous game experience, during the season or in prior seasons), which operates to proportionally reduce the "stressfulness" of any given at-bat situation
- (3) The relationship is further modified by past success and failure (indexed by prior performance and outcome scores, weighted by total experience and by recent experience), with success decreasing and failure increasing the level of stress experienced for any given objective at-bat situation
- (4) There is a curvilinear, or inverted-U-shaped relationship, between stress (both objective and experienced stress) and performance effectiveness (as indexed by observer ratings of batting performance, separate from outcome of time at bat).

Thus this study dealt with all six of the substantive propositions (cognitive mediation, effect of experience, effect of reinforcement, U-shaped relationship, social-interaction effects and task-environmental effects), and did so in a formulation which builds toward a conceptual and empirical integration of these separate propositions. It also involved all three of the key methodological issues --convergent and discriminant response patterns; the study of stress and coping over time; and the study of stress in real-life or natural settings, where much of the data is obtained unobtrusively and where participants are under stress conditions which are real to them and highly motivating.

Results of this study call into question several of the accepted generalizations about the nature of stress. Specifically, the widely held hypothesis that there is a non-monotonic (inverted-U) relation between stress and performance appears not to hold when task difficulty is taken into account. Furthermore, experience does not alter performance by reducing subjective stress, but rather improves performance directly without affecting the degree of experienced stress.

Additional Studies of Phase III

Subsequent to the field study, with its theoretically promising results, several further studies were carried out. One of these was an effort to reformulate the stress model to take into account the findings of study #7. This revised model points up the importance of uncertainty in the stress process. It also attempts to place the stress process in a broader perspective--one which takes into account stresses accruing from tasks, roles and behavior settings. (See reference 12.)

A series of three studies were conducted with three objectives: (a) to develop an effective method for induction of high levels of arousal in controlled laboratory settings (viz. a video tape camera and monitor); (b) to develop multiple and effective measures of experienced stress (viz. pulse rate and PSI); and (c) to test the applicability of the revised stress model for performance of several types of intellectual tasks (viz. learning, novelty preference, concept attainment). (See references 2, 3, and 7.)

List of Publications of the Research Program*

1. Blaylock, Barbara Some antecedents of directional fractionation. Unpublished doctoral dissertation, University of Illinois, Urbana, 1970.
2. Chenoweth, R.E. Effects of arousal and task difficulty on performance in a "concept attainment task". Unpublished M.A. thesis, University of Illinois, Urbana, manuscript in preparation.
3. Cohen, J.L. Audience status, arousal, and performance on hidden word problems. Unpublished M.A. thesis, University of Illinois, Urbana, 1971.
4. Gwynn, Kathy T. The social and physical geography of an organization: behavior settings and interaction patterns. Unpublished M.A. thesis, University of Illinois, Urbana, manuscript in preparation.
5. Kauffmann, D.R. The dissonance-incentive controversy: a study of subject perceptions. Unpublished doctoral dissertation, University of Illinois, Urbana, 1970.
6. Kent, R.N. and McGrath, J.E. Task and group characteristics as factors influencing group performance. Journal of Experimental Social Psychology, 1969, 5 (4), 429-440.
7. Kerr, N.L. Effects of heightened arousal on preference for novel stimuli. Unpublished M.A. thesis, University of Illinois, Urbana, manuscript in preparation.
8. Lowe, Rosemary H. and McGrath, J.E. Predicting characteristics of group output from individual performance characteristics. T.R. #AFOSR 69-2470, Department of Psychology, University of Illinois, Urbana, August, 1969.
9. Lowe, Randall H. Stress, arousal and task performance of little league baseball players. Unpublished doctoral dissertation, University of Illinois, Urbana, 1971.
10. McGrath, J.E., Vidmar, N.J. and Weidemann, Sue R. Social and psychological factors in human stress. Program report: phase 1, Department of Psychology, University of Illinois, Urbana, April, 1967.

11. McGrath, J.E. (Ed.) Social and psychological factors in stress. New York: Holt, Rinehart and Winston, Inc., 1970.
12. McGrath, J.E. Stress and behavior in organizations. In Dunnette (Ed.), Handbook of Industrial and Organizational Psychology, Rand McNally Co. Inc., (in press).
13. Stapert, J.C. and McGrath, J.E. Multiple methods in the longitudinal study of small groups under stress. T.R. #AFOSR 69-2059, Department of Psychology, University of Illinois, Urbana, August 1969.
14. Steiner, I.D. Perceived freedom. In L. Berkowitz (Ed.) Advances in social psychology, Vol. V. New York: Academic Press, 1970.
15. Steiner, I.D. and Darroch, R.K. Relationship between the quality of counter-attitudinal performance and attitude change. Journal of Personality and Social Psychology, 1969, 2 (4), 312-320.
16. Weidemann, Sue R. The risky-shift as a social comparison phenomenon. Unpublished doctoral dissertation, University of Illinois, Urbana, 1971.

*It is anticipated that modified versions of the unpublished reports listed here will be submitted for publication in appropriate scientific journals in the near future.

Bibliography

Campos, J. J., and Johnson, H. J. The effects of verbalization and visual attention on HR and SC. Psychophysiology, 1966, 2, 310-315.

Campos, J.J., and Johnson, H. J. Affect, verbalization and directional fractionation of autonomic responses. Psychophysiology, 1967, 3, 285-290.

Lacey, J.I. Somatic response patterning and stress: Some revisions of activation theory. In M. H. Appley and R. Trumbull (Eds.) Psychological stress. New York: Appleton-Century-Crofts, 1967, pp. 14-37.

Lazarus, F.S., Cognitive and personality factors underlying threat and coping. In M. H. Appley and R. Trumbull (Eds.) Psychological stress. New York: Appleton-Century-Crofts, 1967, pp. 151-172.

Steiner, I.D. Models for inferring relationships between group size and potential group productivity. Behavioral Science, 1966, 11, 273-283.