The Critical Role of Personality and Organizational Factors as Determinants of Reactions to Restricted and Stressful Environments

Robert L. Helmreich

The University of Texas at Austin

Invited Lecture to the Third International Conference on Rest

New York, August 28, 1987

The research discussed here was sponsored initially by the Office of Naval Research and currently by the National Aeronautics and Space Administration, Ames Research Center, under Cooperative Agreement NCC2-286.

The invitation to discuss my research on restricted and stressful environments provided the stimulus to re-examine issues and approaches from the fresh perspective of current work on the determinants of individual and group performance and adjustment. I can say ruefully that had I known then the critical importance of core personality and organizational factors, my investigations would have been embedded in a much broader context. While this application of hindsight may be akin to the proposition that had General Lee had but one thermonuclear device at Gettysburg, the Confederacy would live still, I do feel that reopening old research traditions in the light of new empirical and theoretical approaches can be an illuminating experience.

My research experience with isolated groups was conducted during two extensive saturation diving studies, Project SEALAB II and Project TEKTITE 2. SEALAB was a study sponsored by the Office of Naval Research and conducted off La Jolla, California in 1966 (Radloff & Helmreich, 1968). Three teams of ten Aquanauts each spent two weeks in a habitat on the ocean floor at a depth of 205 feet. Teams worked on a variety of scientific and salvage projects in cold, murky water. TEKTITE was conducted in 1970, sponsored by NASA, the Department of the Interior, and the Office of Naval Research and involved ten five-person teams of Aquanauts spending periods from two to three weeks in a habitat placed in sixty feet of water off St. John Island in the U. S. Virgin Islands (Helmreich, 1972). Each team consisted of

four marine scientists working on a number of marine biological and geological studies and an engineer charged with maintenance of the habitat.

The motives of the sponsors were to demonstrate the feasibility of living on the ocean floor at ambient pressure while spending extended periods of time working in the surrounding sea. In the case of NASA, the setting was (and is) seen as the best analog of psychological environment expected in long duration space missions.

The methodology in both studies centered on continuous, systematic observation and recording of behavior from closed circuit TV and audio links with the undersea habitat. The result was a time-series record of individual and group activities. (It should be noted that the computational power needed to take advantage of this rich database was not available at that time and that analyses involved more static aggregations of records.)

Although the focus of this discussion is on what wasn't studied, it should be noted that a number of significant behavioral findings emerged from the study. These included strong relationships between group cohesiveness and performance, temporal changes in performance and shifts in sleep/work cycles. Other significant findings included the effects on performance of role-sharing and the impact of partial crew rotation.

In retrospect, two of the most theoretically important findings failed to receive sufficient attention. These were: (1) large and highly significant individual differences in

performance and adjustment and (2) the frequent conflicts between crews and their surface based "mission control". The former was a clue to the magnitude of personality influences on behavior in powerful situations while the latter was a marker pointing to the organizational context in which teams operated. Discounting the role of personality was very much in the tradition of situationist social psychology (e.g. Jones, 1985; Mischel, 1968) but also a reflection of the fact that personality measures have not historically been strong predictors of the behavior of normal individuals in either "real world" or laboratory settings. There has also been a tendency to consider isolated groups as microsocieties rather than subcultures whose reactions are heavily determined by their interface with the outside social environment and the organizational structure of this environment (e.g Sells, 1966). I would like to discuss recent empirical findings in each of these areas.

Personality Factors

As a counterpoint to research on isolated groups, a long-standing program of exploration of core aspects of the self has been conducted in collaboration with Professor Janet T. Spence and many of our graduate students. Two core dimensions of personality have been isolated: instrumental traits relating to achievement and goal seeking including aspects of achievement motivation and expressive traits relating to interpersonal behaviors and orientation. Measurement of these attributes is

achieved through psychometrically reliable self-report instruments that assess both positive and negative aspects of these dimensions (Helmreich & Spence, 1978; Spence, Helmreich, & Holahan, 1979). Results in the prediction of performance have been robust in a variety of situations ranging from academics to scientific research to jet aircraft. In the case of pilots, positive performance in command of jet transport aircraft with multi-person crews was related to high scores on positive instrumental traits including a need for Mastery of new and challenging tasks, and low scores on negative instrumental attributes including such traits as arrogance and hostility. Also positively related to performance was possession of high scores on expressive traits including sensitivity to others. The latter finding reflects the fact that operation of a complex aircraft is a group endeavor requiring the close coordination of a crew more than the skills of the lone pilot wearing a white scarf.

Recently, the personality battery has been expanded to include aspects of what has come to be known as the Type A Personality (Jenkins, Zyzanski, & Rosenman, R.H, 1971). The Type A individual is usually described as a driven individual with high levels of ambition, time urgency, impatience, and aggression. Earlier research has suggested that Type A individuals may be both prone to coronary heart disease and more successful vocationally (Friedman & Rosenman, 1974; Matthews, Helmreich, Beane, & Lucker, 1980). Our new formulation of the

construct yields two moderately correlated factors that have been labeled Achievement Striving (AS) and Impatience/Irritability (I/I) (Pred, Helmreich, & Spence, in press). Looking at the two factors in relation to behavioral criteria has shown a consistent pattern of outcomes: Achievement striving is related to positive performance including scientific and academic attainment but is unrelated to negative health outcomes (Helmreich, Spence, & Pred, in press) while Impatience/Irritability is associated with a variety of health complaints including poor sleep quality, headaches, and digestive and respiratory upsets but is not correlated with performance (Spence, Helmreich, & Pred, in press). These two factors are correlated with the instrumental and expressive traits described above and increase the predictive power of the battery.

Important findings regarding personality and performance were obtained in a recent dissertation by Thomas Chidester (1986). Chidester replicated the finding that instrumental and expressive attributes were related to both technical and managerial aspects of flightcrew performance. He also found that Achievement Striving was a positive predictor of performance and that the Impatience/Irritability dimension was related to a variety of health complaints among flightcrew members.

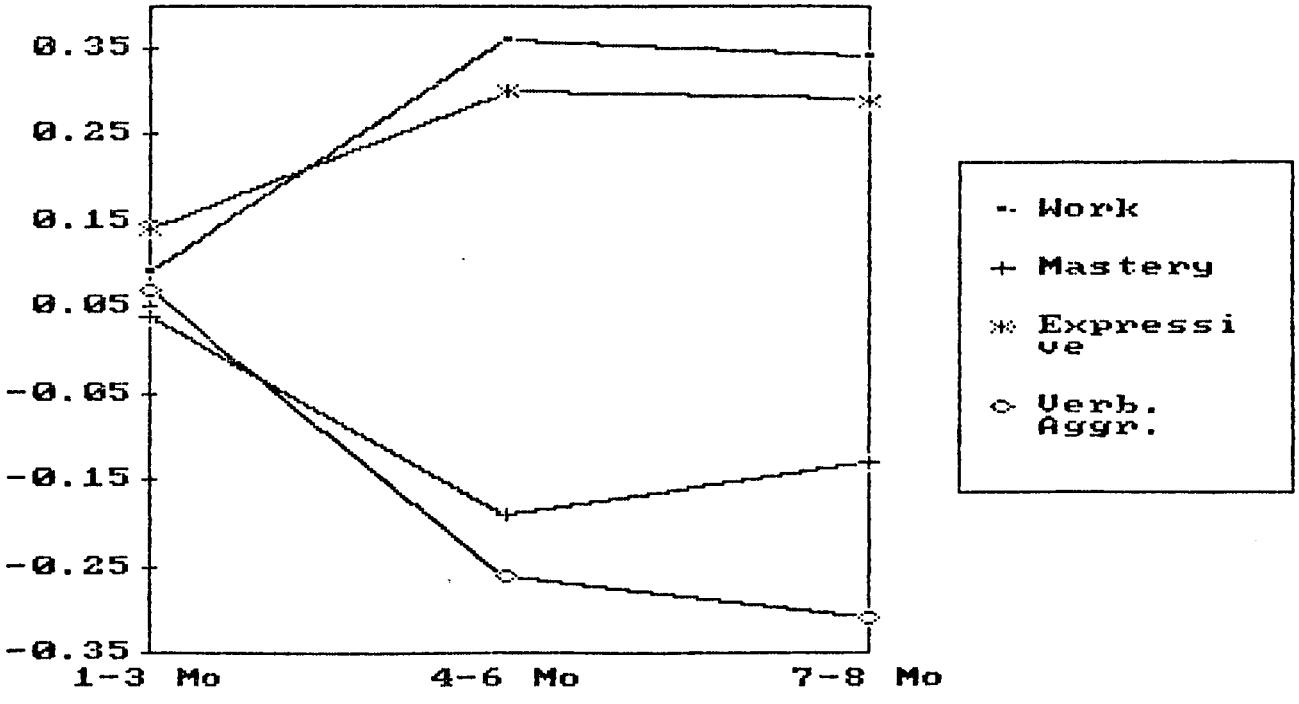
An intriguing question arising from these data is why significant and replicable relationships between personality and performance are being found when the consensus in the literature

is that personality and performance are weakly related if at all. One possible resolution of this seeming paradox may be in what we have christened the "honeymoon effect" of motivation on performance. In a recent study (Helmreich, Sawin, & Carsrud, 1986), correlations between components of achievement motivation and performance over time were examined. At the end of training there were no significant correlations between the predictors and performance in a sample of airline clerical personnel. With the passage of time, however, the correlations increased in magnitude and stabilized. We have interpreted this as reflecting that most individuals, when selected for a desired position, will exert maximum effort to perform well during training and probationary periods and this level of effort may mask the influence of personality on performance. It is not until after the individual has settled into the routine of the position and the "honeymoon has ended" that personality influences on behavior begin to emerge strongly. Looking at the literature on pilot personality, it is notable that the criterion variable almost universally employed is performance in or completion of training while in the present research the criteria involved the performance of experienced crews in line operations. The changing magnitude of obtained correlations is shown graphically in Figure 1. As the figure indicates, two attributes, Work motivation and Expressivity become more positive correlates of performance and two, Mastery and Verbal Aggressiveness become more negative after time on the job. The results for Mastery are

particularly informative. This variable from the Work and Family Orientation measure of achievement motivation (WOFO: Helmreich & Spence, 1978) reflects a need for new and challenging tasks. The job in question, operating a simplified reservations computer terminal, is a repetitive and mundane activity. Clearly, those high on this characteristic do not find this need met after considerable exposure to the work.

Insert Figure 1 Here

Another characteristic of research on personality/behavior relationships may have served to hide meaningful relationships. This is a tendency of investigators to concentrate on limited aspects of the total personality and to look at them in relative isolation. This restricted approach fails to consider the distribution of combinations of different trait intensities - in other words, it fails to look at the constellations of personality combinations that exist in "real people" in the "real world". For example, with what frequency are individuals with <u>both</u> highly instrumental and highly expressive personality traits found in the population or research sample. Thomas Chidester, Steven Gregorich, and the authors have been applying the technique of cluster analysis to determine the distributions of differing combinations of positive and negative personal attributes using the personality characteristics described above (Chidester, Helmreich, Gregorich, & Geis, in preparation;


0.35
0.25
0.15
0.05
-0.05
-0.15
-0.25
-0.35
1-3 Mo
4-6 Mo
7-8 Mo
Work
Mastery
Expressive
Verb. Aggr.

Romesburg, 1984). Depending on the research population, four or five relatively common clusters of individuals with particular levels of instrumental and expressive attributes emerge from the analyses. These clusters reflect meaningful constellations of traits as they are distributed across individuals.

A highly innovative dissertation study by Gibson (1987) demonstrates the utility of this approach. Gibson's study was an examination of relationships between personality factors and ratings of managerial performance. Cluster analyses based on the instrumental and expressive trait dimensions gave five readily classifiable groups. One of these clusters nicely defined the "average" manager. Individuals in this group scored as average on both positive and negative instrumental and expressive dimensions. Three other clusters were marked primarily by the elevated presence of one or more negative personality dimensions and/or low levels of positive characteristics. For example, one group showed high levels of arrogance and hostility combined with low achievement motivation. Another cluster was defined by slightly higher achievement motivation and moderate levels of arrogance and hostility. A fourth group had average achievement motivation but high levels of verbal aggression and negativity. The last cluster was composed of individuals with high levels of the positive achievement motives and expressive traits and low levels of the negative attributes. Figure 2 shows the average performance ratings of the five groups where the ratings are expressed in terms of Z-scores with a sample average of zero. It

is striking that the group with the "average" personality received average ratings with a mean of almost zero. Each of the groups characterized by one or more negative attribute dimensions received below average ratings. On the other hand, the group defined by high positive and low negative attributes received positive mean ratings for performance. In summary, the results obtained using these conceptual variables and the cluster analytic approach to determining the joint occurrence of these attributes in research populations would appear to have considerable theoretical and practical utility. Another application of cluster analysis will be discussed in the following consideration of attitudes and performance.

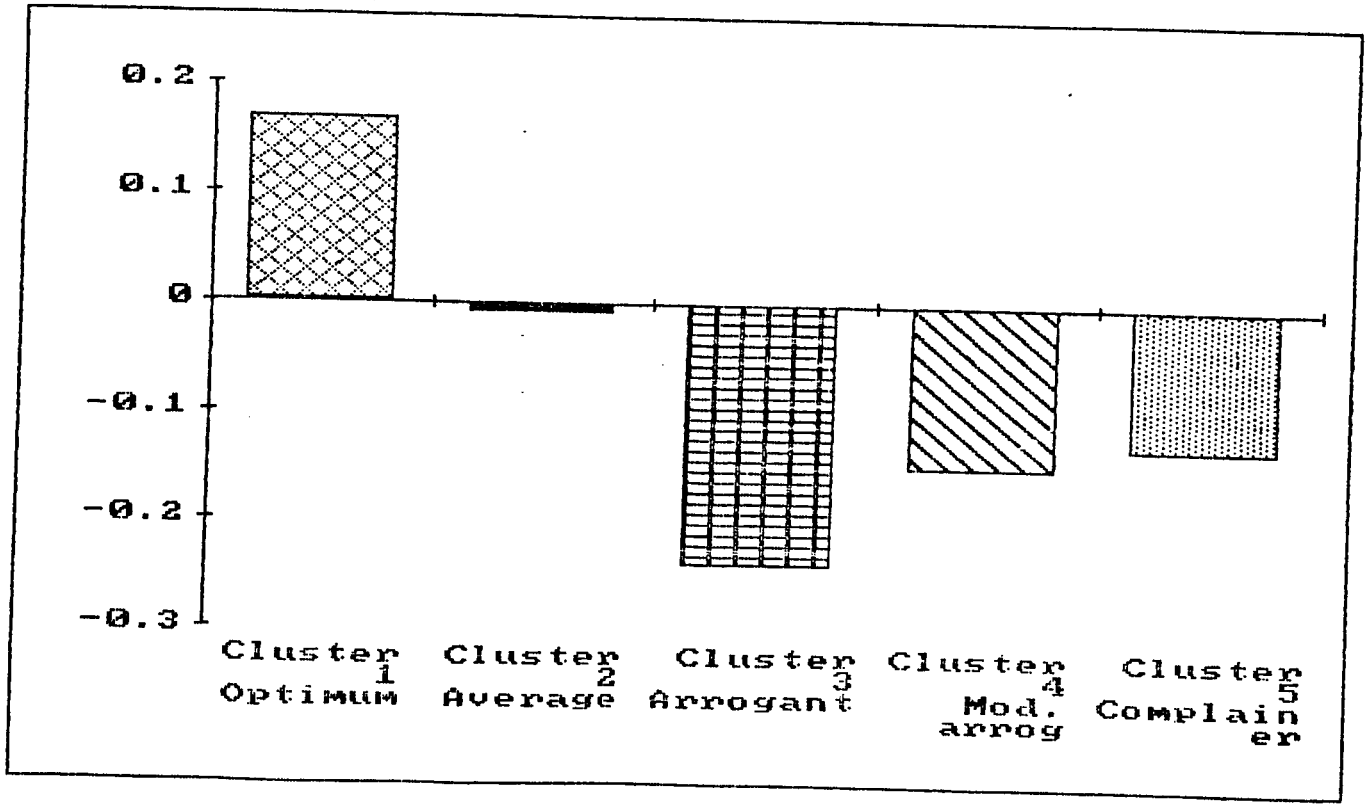
Insert Figure 2 Here

Attitudes and Performance

What about relationships between personality and behavior in isolated environments? I would argue that the relationships should be even stronger as the situation is more intense and the "honeymoon" likely to be quite brief. The question, however, is open.

Organizational Effects

As I noted, investigators have tended to look at isolated groups as microsocieties operating autonomously apart from the larger society. In reality, of course, these groups tend to be highly dependent psychologically and often physically on their


0.2
0.1
0
-0.1
-0.2
-0.3
Cluster 1 Optimum
Cluster 2 Average
Cluster 3 Arrogant
Cluster 4 Mod. arrog
Cluster 5 Complainer

parent organization or society. Lunar missions and undersea habitats were both highly dependent on extensive, earth based support activities for their survival. The organizational structure of SEALAB and TEKTITE was military and hierarchical and Ground Control had and exercised the right to dictate schedules and other activities of the Aquanaut crew. This real and perceived control by an outside force caused considerable discontent in the habitat (and also, coincidentally, served to increase cohesiveness by creating an "us against them" atmosphere which varied as a function of differing exercise of authority by successive managers in ground control. In some instances, open conflict emerged between the two groups.

Similar intergroup disputations have occurred in both the U.S. and Soviet space programs, most notably in a "mutiny" during a Skylab mission where the crew broke off radio contact and refused to work for a full day. The extreme form of this type of relationship between isolated groups and control has many of the earmarks of classic paranoia with perceptions of powerful outside forces controlling the destiny of small groups. A further observed fallout has been an increase in group cohesiveness, but at the expense of building a classic "us against them" psychological environment.

This type of conflict has roots both within the isolated group and in the larger social system that encompasses both. It raises major researchable questions about optimum levels of autonomy for isolated groups and about issues of authority and

command both between and within groups.

Most groups in restricted environments have, almost by default, a vertical, military style, hierarchy with a powerful, appointed leader. It is interesting to note that the Russians, at least by their reports, operate with a much more democratic organization within their spacecraft and with more shared authority between the isolated group and mission control. What is distinctly absent is valid, empirical data exploring intergroup relations in this kind of environment, not to mention data on mission control as a distinct social and operational setting.

Back to the Future

All of the issues discussed above are likely to have enormous operational significance if and when the U.S. mounts one or more of the long duration space habitation programs under consideration. The Space Station, with planned mission lengths of up to three months could become a hotbed of inter and intragroup conflict. Even more disturbing are the implications of sending a small group on a multi-year mission to Mars.

The critical question is how best to research these issues to gain the theoretical and practical knowledge required to optimize crew performance in this type of setting. The option of generalizing from the traditional, laboratory, social psychological study employing undergraduate subjects is not viable for several reasons: 1. ethically, nothing like the intensity or duration of true isolation in life-threatening

settings can be generated in the laboratory and generalization from short term experiences to the real world is questionable; 2. a central feature of natural settings such as undersea habitats is that participants have strong personal motivation to be in such a setting (i.e. meaningful, personal work versus mere participation in psychological research). The inexorable conclusion is that one needs to conduct the research in the "real world", in a setting with participant who consider the activity as a primary professional activity related to their long-term goals. Another option would be to re-examine existing databases from isolated environments. Unfortunately, data on both personality and organizational factors not collected in the original investigations cannot be regenerated.

NASA has, however, made a commitment in principal to sponsor the needed research, using undersea habitats as the test site, with the only restriction being the availability of funds necessary to launch and conduct the studies (Foushee, 1986). Although the cost of such a project is substantial, the payoffs both in theoretical and applied knowledge should be commensurate. The research strategy would involve mounting undersea missions with crews of four to six persons who would be conducting personally meaningful investigations during their stay on the ocean floor. The critical difference between this and earlier undersea projects would be the psychological selection of participants and composition of groups and the <u>experimental</u> manipulation of critical environmental factors such

as mission autonomy and command structure. Because access to the ocean floor for extended periods is so limited, mission candidates should readily accede to the research aspects of the project in exchange for the chance to conduct research under such conditions. Specific questions to be studied include: 1. crew autonomy and leadership; 2. work design and role relationships, including how to deal with scarce resources and to divide necessary housekeeping and maintenance activities; 3. personality-situation interactions looking at particular personality constellations both at the individual and group level; 4. privacy and leisure needs in restricted environments; 5. investigation of non-intrusive means of monitoring the psychological state of participants; and 6. evaluation of the efficacy of training techniques designed to improve crew coordination and relations (a topic under current investigation in civilian and military air transport). Such a project would provide a rare opportunity to refine methodologies for capturing the interpersonal dynamics of small groups and the use of time series analysis to examine temporal effects in group functioning.

From my perspective, it seems that we can gain a great deal from returning to the investigations of yesteryear with the technology and theory of today. Despite this optimism, the challenges involved in funding, designing, and executing such research are at least as formidable as they were two decades ago.