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LEVELS OF ANXIETY IN POLAR ENVIRONMENTS

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Abstract

To test the common assumption that being part of an isolated group in the polar winter represents an anxiety-arousing environment, trait and state anxiety levels were measured in two Argentine stations in Antarctica and two Canadian sites in the High Arctic. The group scores were compared with each other, with comparison groups drawn from the same population as the polar teams but not working in isolated polar stations, and with available norms. Anxiety levels were about the same in both isolated crews, and showed no differences from the comparison groups. Data from Argentine subjects showed some differences from published U.S. norms. A sub-sample of the Antarctic comparison group was retested twice in the Antarctic during the following year. No significant changes were found in either state or trait anxiety. The data support the view that even environments that appear to be dramatically stressful cannot be assumed to have pervasive negative effects; one must look at how the individuals in the environment actually experience it.

Introduction

Like the general public, most scholars (e.g. Gunderson, 1973; Connors *et al.*, 1985) approach any consideration of the polar winter by delineating it as an extreme, unusual and stressful environment for human beings. It is described as *extreme* because survival

is impossible for the unprotected and unprovisioned individual, *unusual* because it is far different from the accustomed physical environment of any other part of the inhabited globe, and *stressful* because the natural environment is dangerous and difficult to access (either for evacuation or for rescue); whereas the built environments—which alone make survival possible—tend to be physically and psychologically uncomfortable (confining, lacking in privacy and amenities, and densely populated) (Suedfeld, 1990).

There is no question, of course, that the polar winter is characterized by daunting physical and social parameters. In the Antarctic and the High Arctic, there are low temperatures, high winds, continual darkness, and little if any available life-sustaining resources except what human beings carry with them. Inside shelters, space, privacy, communications with home, and recreational activities are limited.

Psychologists are well aware of the psychosomatic symptomatology, psychological disturbance, and social conflict that may arise as a result of such conditions. They have quite logically anticipated high levels of stress among groups wintering in these regions (cf. McCormick *et al.*, 1985; Evans *et al.*, 1987), stemming from difficulties in coping with the physical environment (Evans & Cohen, 1987) or with interpersonal pressures (McPherson, 1977) and/or from social conflict and discomfort (McPherson, 1977). Much of the research has been aimed at specifying the negative effects of these variables on cognitive, affective and psychophysiological processes (Paimai, 1963; Barabasz, 1985; McCormick *et al.*, 1985; Taylor & McCormick, 1985; Taylor, 1987). As might be expected, physiological applications have focused on personnel selection and (to a lesser extent) training to minimize the severity

of such problems.

In short, psychologists have viewed the polar regions, and especially the polar winter, from what Antonovsky (1987) has characterized as a pathogenic, rather than a salutogenic, perspective. Some recent analyses, which have recognized the amelioration of environmental stress through modern technology and environmental design, have tended to emphasize the stressfulness of the social situation (Palinkas, 1987). Writers on this topic underemphasize the fact that most polar crew members, as individuals and as groups, have successfully adapted to the environment with all its physical, psychological and social rigors. Most complete their assignments, fulfill their mission goals, stay reasonably sane personally and cohesive socially, and readjust to normal life and the non-polar environment after they return. Many even succeed in repeating this process, and it is possible that polar veterans develop coping skills that they can continue to use in difficult situations elsewhere (Gunderson & Palinkas, 1988).

Our view (cf. Suedfeld & Mocellin, 1988) is that the coping ability of the individual has been underestimated and the difficulty of the environment overgeneralized. Both polar regions are large and quite varied; much of 'common knowledge' about them comes from reports of experiences in the harshest areas, and frequently from individuals who were engaged in activities that maximized the adverse characteristics of the environment—e.g. long traverses, under conditions of either inescapable or voluntarily chosen hardship and deprivation. Some prototypical examples are the early explorations, when equipment and procedures were far below current standards, popularized by books such as Cherry-Garrard's *The Worst Journey in the World* (1922) (Mocellin & Suedfeld, in press). This assumption has been strengthened by contemporary expeditions whose parameters deliberately built in high levels of exposure to the weather and limited use of available modern resources and comforts. Examples of such projects were the International Biomedical Expedition to the Antarctic, trekking over the Antarctic icecap on snowmobiles (Rivoli *et al.*, 1988) and the Steger-Schurke North Pole Expedition, which used only dog sleds and refused any sort of resupply on the way (Steger & Schurke, 1987).

The actuality of normal, present-day polar living is drastically different. It is primarily carried on in restricted, but reasonably comfortable, buildings. Clothing, food, medical care, recreation, communications with the outside world, and so on, are appropriate and fairly adequate. Most crew members need spend little if any time outside when the weather is at its worst. Further, many sites are located in the more tolerable zones of the polar regions. The most populated Antarctic area, for example, is the Antarctic Peninsula, whose low-altitude coastal stations even in winter have milder temperatures than high inland ones (Schwerdtfeger, 1970). With this relative mildness comes more mobility to enhance physical fitness and expend energy, more outdoor activities to reduce boredom, crowding and lack of privacy, and more sea-birds and other wildlife to attract attention, study, and positive affect. It should not be surprising, then, that crews in such locations show relatively little stress (cf. Evans *et al.*, 1987) and that general decreases in motivation and cognitive efficiency have not been empirically demonstrated (Taylor, 1987).

The basic question addressed in this study is whether fear or anxiety among polar sojourners is in fact a major phenomenon and, if so, to what extent and for how long. We also wanted to see whether there would be differences on this variable as a function of location (Antarctic vs Arctic), culture (Latin American vs North

American), employment status (military vs civilian technical vs military dependent), or sex.

We have no doubt that all inhabitants of polar stations experience some stress, and that some experience considerable stress. But 'stress' can be viewed as negative and fear-arousing, as a normal part of life, or as a challenge that mobilizes one to perform at maximal level. This may be a particularly important distinction among individuals who are highly motivated, trained and/or disciplined. It is important to measure the actual experience as perceived by the individuals involved, not merely to infer them from an outsider's look at the environment (Suedfeld, 1987). To draw any general conclusions about the effects of the polar experience, it is then necessary to compare the data with counterpart measures from various sites in the two polar regions and from comparable subjects outside the polar area (Suedfeld & Mocellin, 1988).

Because a question can be raised about the adequacy of psychometric methods in measuring so complex a reaction as that to polar living, and because *Ns* in polar psychology research are usually quite small, participant observation and interview methods were used to supplement the repeated administration of what is probably the most widely known and used test of anxiety, the Spielberger State-Trait Anxiety Inventory (see below).

Method

Isolated polar locations

Antarctic. The two isolated sites were the Argentine stations Vicecomodoro Marambio and Esperanza. Marambio (64° 15' S, 56° 43' W) is on the eastern side of the Antarctic Peninsula, on Seymour Island, 300 m above sea level on an extremely windy and icy plateau with frequent fog cover. Esperanza is located at sea level on the shore of Hope Bay, 63° 24' S, 56° 59' W. Its physical environment is very similar to that of Marambio, except that it is only slightly above sea level and receives less wind and fog. The stations receive only occasional aircraft and no maritime contact during the winter. Absolute temperatures are in the -10° to -27°C range, reflecting the moderating influence of the coastal location of these stations; the stations receive about four hours of sunlight daily.

Arctic. The research sites were the Canadian government's High Arctic Weather Stations (HAWs) at Eureka and Mould Bay. Both are in the Queen Elizabeth Islands, Eureka on Ellesmere Island on the mouth of a fjord (80° 0' N, 85° 56' W) and Mould Bay on Prince Patrick Island (76° 14' N, 119° 20' W). Both are accessible only by charter flights originating from Resolute Bay (see below) or, in emergencies, by military flights from Canadian Forces Station Alert at the northern tip of Ellesmere Island (about 425 miles from the North Pole). During the research period, the prevailing conditions included a total absence of sunlight, extensive ice cover of ground and sea, and absolute ambient temperatures are between -40° and -55°C.

Non-isolated comparison groups

Antarctic. Members of the comparison group were living in Buenos Aires, the capital of Argentina, whose metropolitan area has a population of just under ten million people. As might be expected, their living conditions were those of normal urban dwellers. Weather during the winter is moderate (temperatures above freezing).

Arctic. The comparison group was located at Resolute Bay, Northwest Territories, which is above the Arctic Circle at 74° 43' N,

94° 59' W. Resolute Bay is the logistical and transport hub of the Canadian High Arctic, and is serviced by a number of charter flights as well as four weekly scheduled commercial flights (weather permitting). It has a constant flow of visiting scientists, government personnel and tourists. A native Inuit village is located 5 km south of the station. Weather conditions are about the same as at Mould Bay and Eureka.

Subjects

Table 1 summarizes the locations and numbers of research participants. More detailed information is presented below.

Antarctic (isolated). At the time of the study, Marambio was staffed by 52 male Argentine Air Force personnel. Of these, 13 were 'permanent' staff staying for the entire year, who comprised the sample used in this study. Esperanza was populated by 26 'permanent' personnel, including four married couples, eight children and ten unaccompanied men. The adult population formed the subject group for the study. All of the adult men were army personnel; their wives worked at various jobs on the station. Average ages were 30.2 years for men (range, 24-44), 33.8 years for women (range, 28-41) and 7.6 years for children (4-12). Of the four women, two had previous experience of relatively isolated living (one in a previous Antarctic posting, one in a mountainous area in Argentina); all of the men had had such experience. Two of the children had had a previous year of Antarctic living. Primary duties are the collecting of meteorological data and the maintenance of the stations. In summer, support of scientific research is added to the mission.

Antarctic (comparison). The group consisted of seven Argentine soldiers and their wives, total $N = 14$. The couples had been selected by the Army's Antarctic Operations command for polar service in the future, the selection having been done through the same procedures as those used for the Esperanza isolated sample. The men were assigned to various normal military duties, and the women were either housewives or pursued civilian occupations. Age ranges were 24-36 for women ($M = 31.4$) and 31-35 for the men ($M = 33$). A major difference between the Esperanza and Buenos Aires groups was that the latter had had no isolated posting experience; two of the group had had a brief semi-isolated posting.

Antarctic (longitudinal). During the year following the original study, repeated data collection was conducted among six married members of the Antarctic comparison group, who with eight

unmarried men now constituted the station complement at Esperanza. The three married couples were the subjects in the longitudinal component of this study.

Arctic (isolated). The HAWS at Mould Bay was staffed by eight men and one woman, all employees of the Atmospheric Environment Service (AES), Environment Canada. Seven of these personnel had had previous service at isolated sites. Their ages ranged from 23-55 years. The Eureka AES personnel also consisted of eight men and one woman; however, two members of the crew declined participation in the study. Ages were 22-42 years, $M = 32.1$. All but one had had previous isolated or semi-isolated service. Both groups had weather observation and reporting as their primary mission, with maintenance of the station as a secondary duty.

Arctic (comparison). This group consisted of five AES weather technician employees and nine staff members of the Canadian Ministry of Transport, who were responsible for the administration and maintenance of the Resolute Bay airport. All were male. The age range was 28-60 years, $M = 41.5$. All but one of the subjects had had previous isolated or semi-isolated experience.

Procedure

The first author served as a participant observer during the main data collection at all six locations, spending two to four weeks at each. The second author was present for data collection at Resolute Bay and Eureka. Interviews were scheduled and the psychometric measures were administered only after a high degree of rapport had been reached, and all prospective subjects had been assured that (1) participation was completely voluntary and (2) the research had no connection with their current or present assignments, promotions, etc.

The State-Trait Anxiety Inventory (STAI) (Spielberger *et al.*, 1970) was administered individually to crew members at two isolated stations each in the 'Argentine' Antarctic and Canadian High Arctic, and to one comparable Argentine and one Canadian group located in non-isolated settings. Argentine subjects received a Spanish-language version (cf. Spielberger & Sharma, 1976). The STAI has been shown to measure characteristic (trait) levels of anxiety as well as to reflect increases in (state) anxiety when the individual is under stress or in danger (Lazarus & Folkman, 1984; McCormick, unpublished²).

A second, longitudinal, component of the study compared the STAI scores of a group of Argentine personnel during the year prior to their departure for the Antarctic, at the end of their polar winter, and again just before they returned to Buenos Aires. The longitudinal phase of the study was conducted in Esperanza. Six subjects in this phase, who had formed the Antarctic Comparison group for the main study, were readministered the STAI at the end of the polar winter and again prior to their departure from Esperanza to return to Buenos Aires. STAI administrations in Esperanza were conducted by the station's medical officer.

Results

Participant observations and interviews

At first the researcher was consistently probed by senior crew members before being fully integrated into the group; the fact that J. M. has had considerable previous polar experience accelerated the

Research Subjects ^a			
Group	N	Status	Sex
Antarctic			
Marambio	13	Air Force	M
Esperanza	14	Army	M
Esperanza	4	Army wives	F
Comparison			
Buenos Aires	7	Army	M
Buenos Aires	7	Army wives	F
Longitudinal			
Esperanza	3	Army	M
Esperanza	3	Army wives	F
Arctic			
Mould Bay	8	Civilian	M
Mould Bay	1	Civilian	F
Eureka	6	Civilian	M
Eureka	1	Civilian	F
Comparison			
Resolute Bay	14	Civilian	M

^a Six members of the original Antarctic Comparison group were re-listed one year later to form the Longitudinal group.

Table 1. Research Subjects

process of acceptance. In both polar regions, there were frequent parties, with the feeling that these encouraged interpersonal contact in a relaxed context. Drinking was seen by both J. M. and the crew members as a matter of group compatibility; alcohol use was not perceived as a way of coping with stress.

A high level of sociability existed in both Antarctic stations. The researcher was introduced and her work endorsed by high-ranking officers at each station. At Esperanza, she was the only one of the five women on site to have free access to all quarters and military messes: the four wives were restricted in this because of a sexually-charged incident during a previous winter-over period. At Marambio, she was the only woman on base among more than 50 men, and was always accompanied by the base commander or medical officer when moving around the station.

Even during a long period of bad weather (e.g. 150-180 km/h winds), the atmosphere was relaxed. Crew members and wives openly discussed personal reactions and general issues; they also commented on her behavior during the interviews and test administrations. There were frequent parties, with music and alcohol; these and humour were seen as major coping strategies. She had no impression that people were pretending less fear or stress than they were actually feeling.

In the Arctic stations, crew members were more introverted and took longer to accept her fully. Again, social drinking was both a frequent activity and a test: crew members would offer drinks, then watch to see what effect these had and whether she would lose appropriate role behavior (e.g. control, confidentiality) during the party. When they were reassured that this would not happen, they became more confiding. However, of the Ministry of Transport personnel at Resolute Bay, only the more mature and experienced members co-operated in the research. Younger employees (unlike the equally young but generally more highly trained AES weather technicians) were reluctant to participate.

A generally positive mood characterized the polar interviewees. All of the stations had a reasonably high proportion of personnel with previous experience in isolated or semi-isolated sites, which increased the sense that the environment was not bizarre or threatening. Although the Canadian Arctic crews described themselves as less oriented toward social contact than the Argentine Antarctic crews (fitting the cultural stereotypes), they showed no striking differences in their adaptation to the environment nor to each other.

It is worth mentioning that (aside from the visit of the researcher) only Mould Bay was completely isolated during the research period. Marambio and Resolute Bay are major air transport centres for their respective regions; a flight crew (including a high-ranking Air Force officer) was stranded at Esperanza for some time because of bad weather; and Eureka was visited by a planning team from the AES and by a group from the Shell Oil Company. The presence of visitors tended to accentuate the partying and pleasant mood (although the same pattern was found at Mould Bay, which had no outsiders except for J. M.).

STAI results. The isolated Arctic group scored within, but toward the lower range, of published norms for both components of the STAI (see Figure 1). In the absence of available norms for Argentine (or even South American) samples, we cannot meaningfully compare the Antarctic data with a norm group. However, the Arctic-Antarctic comparison showed no significant differences,

Figure 1. State and trait anxiety key: x = U.S. STA1 norm; ■ = Arctic isolated group; ▨ = Arctic comparison group; ▤ = Antarctic isolated group; ▥ = Antarctic comparison group.

Figure 2. Longitudinal data, Esperanza Base. key: x = U.S. STA1 norm; ■ = pre-polar year; ▨ = end of polar winter; □ = pre-return.

and it may be that the norms for the two national samples would not be too different. The isolated Antarctic group was lower than the U.S. norm on both state and trait anxiety, overall Hotelling $T^2 = 14.70$, $p < 0.003$; for state anxiety, $T(34) = -3.81$, $p < 0.001$, for trait anxiety, $T(34) = -2.89$, $p < 0.01$. Antarctic controls, on the other hand, had a significantly lower score than the norm group on state anxiety only, $T(6) = -2.66$, $p < 0.05$.

There were no significant differences on ANOVA or MANOVA among the following: Arctic isolated and non-isolated groups, Antarctic isolated and non-isolated groups, Arctic and Antarctic isolated groups (see Figure 1). There were also no differences between the two isolated samples in either region, nor between men and women.

Mean scores on the longitudinal STAI administration are shown in Figure 2. Within-subjects ANOVA with repeated measures showed no significant differences across administrations.

Discussion

The two polar regions did not show high or differentiated patterns of anxiety among the wintering occupants of isolated stations. Similarly, within each region the isolated and non-isolated groups had about the same anxiety levels. There was no evidence of change in anxiety levels during the Antarctic winter. Several aspects of these comparisons may emphasize the consistency of these results.

The Arctic and Antarctic isolated sites were not only geographically widely separated, but were operating under very different climatic conditions. In addition, the personnel belonged to two highly disparate cultures (Anglo-Saxon and Latin American) and subcultures (civilian weather technicians and military support and maintenance personnel). The HAWS staff, and those stationed at Marambio, lived celibately in a predominantly or completely masculine environment; at Esperanza, a significant proportion of the population lived in family groups, and those who did not had daily contact with the families.

Within each geographic region, living conditions varied to different degrees. The difference was most marked in Argentina, where the non-isolated comparison group lived in a very large metropolis with all modern urban characteristics. The city also has a relatively mild winter climate, and no diminution of activity due to weather. The Buenos Aires subjects were members of the same organization as the isolated samples, and had been passed for polar service in the same way. However, all were married and living with their families.

In Canada, the comparison group was located in an environment that is climatically very similar to that of the isolated stations, and could itself be classified as semi-isolated. The group here included both people whose training and selection were very similar to the isolated weather technicians and those who came from different backgrounds and performed very different functions for a different employer. In light of these variables, the lack of intersite and intergroup differences in anxiety indicates that polar isolation stress, to the extent that it exists at all, was being tolerated without noticeable increases in anxiety. It is also worth noting that every group approximated the norm for trait anxiety; in other words, this was not a self-selected anxiety-proof sample.

Under current conditions of polar work, which include technological efficiency in overcoming the low temperatures, high winds, limited food supply, etc. of the winter, the major physical stressors remaining are probably the absence of sunlight (not of light, since artificial light sources are present) and restricted mobility and exercise. Both of these factors increase feelings of monotony and boredom; more serious episodes of depression may result from biochemical effects of insufficient sunlight (Dubbels, 1984). Our data indicate that there is no heightened anxiety in response to these stressors. This is consistent with the findings of Evans (1986), Evans *et al.* (1987), McCormick (1983) and Mocellin (unpublished³) that stress levels in polar situations are not as high as is generally assumed. It may also be the case, however, that psychometric instruments fail to pick up some stress reactions (McCormick *et al.*, 1985).

Well-prepared personnel have an enhanced ability to cope

with the polar environment, including its stress-inducing social pressures (Defayolle *et al.*, 1985; Gunderson & Palinkas, 1988; Lantis, 1968; Lugg, 1975; Mocellin, unpublished⁴). The majority of our subjects had had previous isolation experience, and also had served for several months at their current site prior to the study. Informal conversations clearly indicated that they felt their major adaptation processes had occurred within the first two weeks on site, and had been completed by the time of testing. Thus, they had reached good adjustment. It may also be that they had personality characteristics conducive to adaptation, although selection criteria at both poles focus on job skills rather than on personality measures.

Researchers should study environmental stress in terms of interaction effects-experiences within settings-rather than main effects (Suedfeld, 1987, 1990). The environment has only an indirect impact on human beings, after being filtered through psychological and physiological information processing systems. These and other research findings agree in pointing to a changed conceptual starting point for research on human behavior in such environments.

Notes

- (1) Jane S. Mocellin, to whom correspondence and reprint requests should be addressed, is now at the Department of Psychology, University of Manitoba, Winnipeg, Man., Canada R3T 2N2. This paper was based on a dissertation submitted in partial fulfillment of the requirements for a Ph.D. at The University of British Columbia (see Note 3). The first author acknowledges the guidance of the dissertation committee (Peter Suedfeld, J. K. Stager, Olav Slaymaker and L. M. Ward), and the support of the following agencies and institutions: the Federal University of Rio Grande do Sul (Brazil), the National Council of Development of Scientific Research (CNPq, Brazil), the Humanities and Social Sciences Research Council of Canada, the Antarctic Institute of Argentina and the Atmospheric Environment Service, Environment Canada (especially Mr Dennis Siossel, Senior Advisor on Polar Affairs).
- (2) McCormick, I. (Unpublished). Psychological aspects of stress in the Antarctic. Ph.D. thesis (1983), Victoria University of Wellington, New Zealand.
- (3) Mocellin, J. S. P. (Unpublished). Levels of anxiety aboard two expeditionary ships.
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