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QMFCIAF REPORT NO. 34-62

HUNGER IN GROUPS: AN ARCTIC EXPERIMENT

Interim Report

August 1962

QUARTERMASTER FOOD AND CONTAINER INSTITUTE FOR THE ARMED FORCES
QUARTERMASTER RESEARCH AND ENGINEERING COMMAND, U.S. ARMY
CHICAGO 9, ILLINOIS

AD ________ Accession No. ________

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pp 355 tbl 105 fig. 34

Hunger in Groups: An Arctic Experiment by Richard W. Seaton

This report deals with an interim phase of research on aspects of U.S. Army Quartermaster supply and undersupply in a selected polar environment. The research emphasis in this phase was upon

Primary Field: Small group dynamics
Secondary Field(s): Environmental stress

UNCLASSIFIED

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2. Greenland
3. Military psychology
4. Logistics
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PROJECT:	Human Factors in Quartermaster Corps Operations
TASK:	Attitude toward and acceptance of Quartermaster materiel
PHASE:	Psychosocial aspects of undersupply

HUNGER IN GROUPS: AN ARCTIC EXPERIMENT

Interim Report

by

Richard W. Seaton

Food Acceptance Branch, Food Division

August 1962

Quartermaster Food and Container Institute for the Armed Forces

ACKNOWLEDGEMENTS

Praise and gratitude are due to the twenty men who made the man-haul over the Icecap. They are:

Daniel Bair	Thomas Maples
Willie Banton	Aaron Moore
Donald Bell	Raymond Muse
Leland Berry	Edward Rauh
Donald Davis	Richard Reichard
Lawrence Gondeck	Raymond Shady
George Hobarth	Eugene Sload
John Jenkins	Theodore Stokes
Donald Koch	Thomas Tate
Robert Lee	Russell Webb

Among others who contributed generously to this experiment on hunger were: Mr. Tom Dee, Quartermaster Project Leader on the Greenland Icecap, who sustained the plan of the experiment in the face of repeated difficulties; Mr. Wayne Hamman and his staff at the Quartermaster Food & Container Institute for the Armed Forces, who sustained the burden of the statistical analyses; Drs. Rossi and Davis of the University of Chicago, and F. J. Pilgrim of the Food & Container Institute, who patiently scrutinized both the planning of the experiment and the allegations of the report; and Dr. E. Paul Torrance of the University of Minnesota, pioneer in the study of groups under environmental stress.

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HUNGER IN GROUPS: AN ARCTIC EXPERIMENT

CHAPTER I

INTRODUCTION

It is becoming almost conventional for students of hunger to remark that "nothing has been written on the subject." There is, of course, A. T. Richards' (1948) well-known work of three decades ago; however, Malinowski's introductory prediction that it would forerun a flood of other studies on the subject has not come true. Sorokin (1942) discusses hunger in his work on disaster; Holmberg (1950) underwent semi-starvation with the Siriono; Cohen (1955) won an AAAS prize for a paper on the relationship between child-feeding practices and social generosity; and there is the great work by Keys *et al*. (1950) at Minnesota (including a book by Guetzkow and Bowman [1946] on effects of hunger on social behavior). A summary comparison of listings on sex and hunger in a large university library (Chicago) card-catalog points up the relative neglect of hunger; there are only two dozen entries under the "hunger" heading, whereas there are twelve hundred library cards filed under the heading of "sex."

There are reasons for this neglect. Contrary to folklore about the starving artist, people who read and write books do not often have first-hand experience with hunger; sex, on the contrary, is universal. True, the novelist Knut Hamsun (1921) has given a subjective report on hunger; again in contrast to sex, however, hunger has yet to form the basis of a contemporary novel.[1]

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[1] Possible exception: John Steinbeck's *Grapes of Wrath*.

Castro, in The Geography of Hunger (1952), has another explanation for the literary and scientific neglect of hunger. He says it is due to puritan morality. Hunger is regarded in western European and American middle-classes as something to be ashamed of, a sign of low moral worth. Recurring literary fascination with bums, hoboes, and gypsies may derive from the outré character of their philosophies rather than from the deficient character of their nutrition and habilitude.

On the scientific side, research on hunger in man has been hampered by the lack of experimental evidence and the ethical, monetary, and administrative costs of obtaining it. Observed *in situ*, hunger or underfeeding is always so confounded with a multitude of other variables (relating to disease, disaster, culture, etc.) that isolation of its effects is impossible.[2] Laboratory-type or controlled field experiments have been few, and almost all have taken place in relation to defense activity. The subjects of these few experiments have usually been "high-type" volunteers, but even so the hostility engendered by hunger has made administrative test control difficult. The research emphasis typically has been on physiological and psychomotor "hardware" data on military performance characteristics without especial theoretical import for military social psychology and sociology. In only one research (the large Minnesota study) was effort made to report systematic evidence on behavioral and personality effects of hunger. However, "The Minnesota Experiment was designed to explore the biology of human starvation; the social factors were held, as far as possible, 'constant'," reported Keys *et al.* (1950, p. 916).

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[2] "The welter of literary presentations of impressions, anecdotes, and personal rationalizations relating to the psychology of starving persons is enough to produce despair as well as exhaustion in an attempt to winnow out the real and the significant" (Keys *et al.*, 1950, p. 767).

No experimental research in the past has looked beyond the individual subjects to observe hunger effects on their social organization.

The opening-up of the polar regions by modern transportation developments (helicopters, snow-going vehicles) has brought them within the military purview as potential operational areas. Performance data in these areas are needed. Logistical problems make undersupply always a possibility, and food represents a major item of supply. Therefore, evidence on Arctic performance during underfeeding is desirable.

The Arctic regions represent an advantageous situation for the conduct of experiments on underfeeding because they are work areas. Underfed men in laboratories develop a resistance to work which is hard to overcome administratively; yet physiological evidence on work during underfeeding is needed. The Arctic setting eases this problem because the environment requires a relatively high minimum of activity and energy output. The isolation of the Arctic also allows good control over food input; even "high-type" volunteers will steal food if given the opportunity, but the isolation of the Arctic reduces these opportunities considerably.

For these reasons the Army decided to support a Quartermaster test of underfeeding in the Arctic during the summer of 1960.

As it finally evolved the planned test became an experiment with two replicated cycles, each consisting of a five-day control phase followed by two five-day experimental phases during which subjects trekked over the Greenland Icecap man-hauling sleds. Variables included eight subgroups paired into five-man teams, two feeding conditions, and two work conditions.

Many emergencies arose, requiring modifications of original plans. The logistics of testing in this isolated spot were enormous, e.g., a man's catching cold, or the loss of a typewriter ribbon, had considerable implications for the success of the venture. Yet on the whole the test plan was carried out successfully, without loss of subjects during the experiment and with collection of all required data.

In the next chapter are discussed questions on which the experimenter hoped to throw light. The third chapter gives the planned test conditions in detail. Quantitative findings are reported in the fourth chapter. Implications of the findings are considered in the concluding chapter.

Fig. 1.--Man-hauling in the Arctic

CHAPTER II

THEORETICAL CONSIDERATIONS AND TEST PURPOSES

A prominent student of stress in human groups has likened its social effects to events in the Selye adaptation syndrome (Torrance, 1959). In terms of a hypothetical ratio which includes a group's facilities or resources in its numerator, and which includes the internal responsibilities and external demands impinging on a group in its denominator, an increment in external demand induces group mobilization of available resources. This may be done at the cost of not fully meeting other normal maintenance requirements. Once response attains parity with demand, maintenance demands resume saliency. When adequate progress is being made in work, activity returns to supportive functions and the general capacity of the group to satisfy member requirements is reinforced. If the increment in external demand stress is large or if support activities must be deferred for a long time, change in existing structure and organization may be necessary before equilibrium is reestablished. Old obligations are dropped in favor of more pressing needs of members or requirements of external press. This produces a flexibility of organization and egalitarianism of structure which may be retained in part after release from stress (Torrance, 1958).

Thus with the onset of a flow of demand from the environment, groups can usually mobilize resistive resources via ordering of communication, centrality of power, display of affect and socio-emotional support patterned in terms of member task performances, and reassertion of group goals. Minor adaptations of this sort are ever-present in on-going working groups (Blau, 1957).

Their effects on the cohesiveness (i.e., the power of the group over the individual, or the attractiveness which the individual holds for his co-members) of groups undergoing more notable stresses is well documented. Shils and Janowitz (1948) have reported the success of German military squads in adapting to meet member needs. In Festinger's (1958) view, the very struggle which the group requires of its members leads to high morale and cohesiveness. Others would view this outcome as the result of reinforced and clarified structuring resulting from the imposition of group demands on members.

Social effects of threat stress may be otherwise. Threat imposed on individuals, especially when differentially imposed, may reduce member willingness to be concerned about or to contribute to group tasks and supportive functions. Unless threat is perceived as soluble by group attack either on the problem posed or on the threatening agent, it thus induces a decline in the numerator of a group's resource-demand ratio. Group interaction then decreases even while group task structure and organization may remain ostensibly stable; members may need support from their group but they are too pressed by their own worries to reciprocate support. Since the group is less satisfying, affect declines and hostility may increase; membership being less valued, members may attempt to leave, thereby further weakening the group.

This pattern of threat stress effects may be modified when a threat is minor, when all members suffer the same potential personal deprivation, when a threat common to all members is viewed as a threat to the group, or when threatened members' acts of private self-interest must be displayed in public and may be exposed to censure by co-members. Smith (1958) has reported testing the effect of threat on group members' willingness to sacrifice their own benefit to conformity with the normative path to a group goal. The expected non-conformity under high threat appeared. However, when the occasion for non-conformity was more overt, threat effects were much reduced. This implies that the group has resources in the face of the distracting strains on individuals which may threaten the stability of the social formation; in Smith's case, the threat of social sanction appears to be such a resource.

Food deprivation should operate the same way in gr .ps as does threat, except that since the need is real rather than potential, the impact of its miseries enhance members' self-concern at greater cost to concern about group action. By the time hunger becomes actual, no group action is likely to help; otherwise members would not have become hungry in the first place. Other derivatives of hunger will also contribute to the weakening of group access to member resources. These are irritability and subjective weakness. The first implies that social exchange has potential negative value; the second means that even if group members are pressured to contribute to group ends, they will feel they can afford to give only a little energy because they have little to give.[3] Like a disease, hunger should be a stress most conducive to attrition of social units. Group punishments for deviant, selfish, or inadequate behavior are likely to be little availing on tired and miserable men, and even application of sanctions takes energy which members may not be willing to supply. No matter how well structured, no matter how adaptable, a group faced with hunger stress presumably is threatened with disintegration.

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[3]In point of fact, moderate short-term underfeeding has little or no effect on physiological performance capacity.

One of the objectives of the Quartermaster experiment in Greenland was to see if the supposed social effects of moderate food deprivation would come true when other sources of stress were held constant and specified. For purposes of contrast with the food deprivation variable, a slight variation in task difficulty was included in the test design. There were other aims as well. A second aim was quantitative confirmation of subjective phenomena frequently informally mentioned in survival reports; there are a multitude of such reports but they are not always in agreement about correlates of hunger.

A third aim was satisfaction of curiosity. In everyday life, groups are rarely as arbitrarily formed, isolated, totally interdependent, and compulsorily constrained as were those in the Greenland experiment. These experimental groups were rarae aves, such as one might encounter on life rafts at sea, in POW camps, or among guerrillas. Opportunity to see how they developed and maintained social characteristics in the face of hard work and hunger was intriguing to the experimenter.

CHAPTER III

THE EXPERIMENTAL PLAN

Overview

Some indication of the planned experiment has been given in the first chapter. More details (chronology, experimental design, etc.) can be found in subsequent sections of this chapter. What follows here will be a brief review of the sequence of experimental operations.

The experiment consisted of two cycles or repetitions which partly duplicated each other. In each cycle, four separate small teams were established. Each cycle began with members of the teams becoming accustomed to living and working with co-members during a preliminary control phase. Before and during the control phase of the first cycle, the work consisted of learning how to camp on the Greenland Icecap and how to march on snowshoes across it with field equipment. During this preliminary period subjects physically unfitted for the subsequent experimental phases of the test were weeded out while remaining subjects became acclimated to the environment, conditioned to the task of trekking across the Icecap, and accustomed to working with their teammates.

In the control phase of the second cycle, subjects were already acclimated to Icecap treks. However, team membership compositions were shuffled and time was allowed for members of the resulting new teams to become accustomed to one another. Their work during this second control phase consisted of spending half-days building snow shelters; the remainder of the days during this phase of the second cycle were given over to rest and eating. Questionnaire and instrumental data were obtained toward the end of each of the two control phases, to be compared with data obtained during and after subsequent experimental phases of the test.

In the first experimental phase of each cycle, a ten-day cross-country trek was begun. On this trek, two of the four teams were on full rations, which meant that they could eat approximately 4800 calories daily if they wanted to. The other two groups were restricted to half this amount. Within these two ration levels, one team started out carrying personal gear in rucksacks on their backs with only team living equipment (tent, stove, etc.) on the two sleds they pulled; the other team carried no personal equipment on their backs and instead piled all gear on their two sleds while marching. During this first phase, all teams were marching outbound from their base camp, moving roughly abreast beside a marked trail over the Icecap leading to the coast. A wagon train housing observers and administrative personnel moved parallel with them. At the end of the first ("outbound") phase, the teams reversed direction and marched back to the base camp from which they had started. At the same time, teams switched methods by which they transported personal gear and equipment, those first carrying personal gear on their backs now carrying it on sleds, and vice-versa for those who started out with gear on sleds.

The second cycle, beginning shortly after return to base camp at the end of the first ten-day trek, started with a switch-around of team-members between the two groups which had been on low rations, paralleled by a comparable switch-around among the two teams which had been on full rations. Once again a five-day control phase of exercises around the base camp began, to enable the groups to become physiologically comparable and socially stabilized.

Then a second ten-day trek began, this time with groups previously on full rations now on half-rations, and vice versa. The same switch-around of team transport methods took place midway on this trek as took place on the first trek.

In addition to the variables in the main design (teams, time, task difficulty, food), certain sub-experiments were made on vicarious reduction of subjective hunger and promotion of intra-group interaction via discussion of non-food problems. These experiments are the subject of another report and are not discussed here.

Sequence of Events

1-18 June	Pre-operation training and instruction of test subjects at Fort Lee, Va. Administration of physiological and personality tests. Final screening of subjects.
19 June	Departure of the field manager, aid, and social psychologist for Camp Tuto, a military post adjacent to Thule Air Force Base on the coast of northern Greenland.
20-30 June	Orientation and acclimation of the advance party. Establishment of final details of the test program and of arrangements for support.
1 July	Departure from the U. S. of the main body of military test subjects, observers, and support personnel for Greenland.
2-5 July	Arrival of main body. Issuance of Arctic clothing. Embarkation on snow train to Camp Fistclench, 180 miles into the Icecap.
11 July	Arrival at Camp Fistclench.
12-17 July	Issuance of Arctic equipment. Orientation of test subjects. Administration of pre-operation questionnaire and sociometric schedule. Taking of pre-operation physiologic measurements. Beginning of training for the cross-Icecap trek.
18 July	Formation of test teams and relocation of habitation arrangements to conform to team groupings.

19-24 July	Control period. Beginning of Cycle I. Final training exercises in the areas surrounding Camp Fistclench by teams, on full rations. Control period physiologic measurements. Shake-down of social structure of groups and elimination of unfit. Control period psychologic, attitud and sociometric measures.
25 July-3 August	Ten-day cross-country trek by the four teams. Application of main experimental treatments by team and test phase. Application, to all teams, of intra-week experimental devices to reduce subjective stress. Daily noon interviews. Application of respirometers on alternative days. Team activity diary maintenance by observers. Other physiological measures (weight, etc.). Weekly administration of attitude-cum-sociometric questionnaire. End of Cycle I.
4-11 August	Control week; beginning of Cycle II. Reorganization of subjects into new teams and rearrangement of bunking. Physiologic measures marking end of Cycle I. Replication of control phase of 19-24 July except exercises were briefer and stressed team coordination and skill rather than physical buildup.
12-21 August	Cycle II replication of ten-day trek.
21-24 August	Termination of Cycle II. Final physiologic measures for Cycle II. Post-operation attitude and sociometric questionnaire for entire group of test subjects. Turn-in of equipment. Departure of entire group for Camp Tuto.
29-31 August	Arrival at Camp Tuto. Turn-in of personal clothing issue. Terminal interviews with individual subjects. Return to the United States.
1-4 September	Arrival at Quartermaster Research and Engineering Headquarters, Natick, Massachusetts. Post-operation physiologic measures. Termination of test.

The Basic Task

The basic task of all four teams was to move themselves on snowshoes with their supplies and equipment (except fuel and food) on sleds for ten days across fresh snow adjacent to a trail across the Icecap. Leaving the base camp (Camp Fistclench), 180 miles from the edge of the Icecap and at an elevation of 7000 feet, they progressed at a rate of eight miles a day toward Camp Century, an under-ice installation about 100 miles from the edge of the Icecap at an elevation of 6000 feet. After five days on this downhill leg, on the sixth day they turned about and backtracked uphill for five days to Camp Fistclench.

Between the two camps mentioned there is a sledging trail marked by flags every mile. This is the main supply route to Camp Fistclench. The four test groups marched parallel to this trail and some small distance to the north of it, in the first cycle.[4] The four groups marched approximately abreast; during clear weather the teams were spaced at approximately 100-yard intervals from each other. They were allowed to lag or lead one another by as much as 200 yards while underway; if the longitudinal gap became greater, the lead groups were ordered to reduce their speed to allow lagging groups to catch up. Lateral positions of the teams relative to the trail and to each other were rotated daily.

Trailing behind each pair of teams as they marched were one or two "weasels" manned by the auxiliary enlisted men who would have served as replacements had disability required any of the team members to drop out of the march. The tracked weasels, equipped with short-range radios, were maintained mainly as a safety factor in the event of a sudden blizzard or white-out. They also carried such test equipment as might be needed on the trail and were used to carry observers from the mobile test center to the marching teams.

The within-team trail procedure was standard for man-hauling sledges

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[4]During the trek in the second cycle, both sides of the trail were used, two teams on either side.

Fig. 2.-- The four teams on the march. Usually the teams were much more spread out and the wanigan train was usually well out ahead.

in the Arctic. One man broke trail.[5] Next followed two men in a split harness pulling a sled, followed by the last two men, also pulling a sled. The men in these three positions were rotated approximately every twenty minutes, so that each man filled each position approximately the same amount of time.

At the close of a day's march, the teams closed in toward the trail and formed camp, each group located at the corners of a rough trapezoid and each about 200 yards distant from the mobile test center located on the main trail. This mobile center was made up of a train of box cars on sled runners (wanigans) in which the scientific observers and support party lived and performed indoor work. In addition to bunk shacks, the train included a cook shack, mess hall, and common room, and also a test-and-communications-equipment center. One sled held supplies. The whole train was pulled by a D-8 30-ton tractor. Once each day it advanced eight miles along the trail and marked the termination of the daily march.

During the treks, the teams were kept as isolated from each other (and from high-ranking visitors) as possible. The test was classed as an isolation experiment, and visits by outsiders were minimal. Social exchange between the teams was actively discouraged. A reinforcing factor here was the fatigue of the teams and the fact that when not marching they tended to want to spend as much time as possible in sleeping bags in their own tents.

During the first and fourth ("control") phases, when the men were exercising daily but housed in quarters in Camp Fistclench in the evenings, the control over social exchange was of course minimal.

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[5]The men thought this to be the easiest trail position.

Water, Food, Fuel and Equipment

The basic ration was four boxes of C rations issued daily to individuals. Each box contained a varied meal of approximately 1200 calories. There are twelve different basic C-ration menus. Each box contains, in addition to a five-oz. can of a meat or meat-substitute dish such as beef stew or ham and eggs, such miscellaneous items as packs of four cigarettes, toilet paper, matches, hard candies and the like. The ration may also contain canned bread or jam, canned cake, or canned fruit. Precise control was kept on each of the different food items in the boxes issued daily to each man; that is, each item in a box was listed and weighed prior to issuance, then re-boxed and assigned to an individual; containers and wastes were later returned by individuals and weighed again. Men were told not to trade, and the evidence suggests that trading was not frequent. The men were allowed to eat daily issued foods at their own discretion but they were not to save food from one day to the next. For this reason each container or package was "counted in" as well as "counted out." Arrangements for teams on half-rations were the same except that the number of boxes issued daily was two rather than four. All food for each team was picked up by one man from that team delegated to collect it. This system reduced social contamination around the supply tent. For the same reason, food-pickup agents came in from their teams one by one.

Gasoline (Yukon) stoves and approximately three gallons of gasoline daily were supplied to each team for food preparation, water melting, sock drying, and tent heating. Individuals could heat the cans of food at morning and evening meals if they wished. However, stoves were not to be used during the noon meal period on the trail: the men were expected to conserve low-moisture, ice-free items for the noon meal. Men would often melt snow for their needs during the morning and evening meals and heat food cans in the hot snow water. One-quart insulated water canteens were carried for use on the trail.

Full military Arctic clothing was issued to each subject. This issue provided ample protection for even the lowest temperature (e.g., -20° F.) likely to be encountered during the experiment.

With the exceptions of daily fuel and food supplies, the teams were outfitted with full equipage for activity on the trail in the Arctic, e.g., 6-man tent, round-bottomed sleds, entrenching tools, and shovel. Rifles, flares, binoculars, and like military hardware were, however, not carried. The total weight of all food, fuel, clothing, and equipment for a five-man team was approximately 450 lbs.

Source of the Subjects

The U. S. Army Quartermaster Corps maintains, within the province of its Research and Engineering Command, a Field Evaluation Agency at Fort Lee, Virginia, where the multifold items of personal and unit equipment supplied by the Quartermaster are tested for extended periods under simulated conditions of operational use. In addition to civilian technicians, scientists and other personnel, about 200 military officers and men are assigned to the station. Duties of the latter include administering tests and surveys of equipment and supplies and acting as test subjects in physiological tests and tests of equipment. These men are not volunteers and are not specially selected. Their assignment to the Quartermaster Corps, and to its Field Evaluation Agency, is a matter of routine personnel practice. A tour of duty at the Field Evaluation Agency customarily lasts from two to three years. During this period the men are exposed to a wide variety of assignments at Fort Lee or at Quartermaster test sites in Yuma, Arizona; Fort

Churchill, Canada; the Panama Canal Zone; or on the top of Mt. Washington, New Hampshire.

Almost all of the men have had some high school experience; somewhat more than half have high school diplomas; and very few (outside of officers) have had college experience. Most are in their early twenties. Their fathers' occupational backgrounds cluster mainly in the "labor" and "service" census classifications. They tend to come from large families.

Characteristics of the twenty men selected for the experimental treks are given in the first section of Appendix A.

The Setting and Its Stresses

> The interior of Greenland today is simply an elevated, unbroken plateau of snow, lifted from five thousand to eight thousand and even ten thousand feet above the level of the sea; a huge white glistening shield some twelve hundred miles in length and five hundred miles in width, resting on the supporting mountains. It is an Arctic Sahara, in comparison with which the African Sahara is insignificant. For on this frozen Sahara of inner Greenland occurs no form of life, animal or vegetable; no fragment of rock, no grain of sand is visible. The traveler across its frozen wastes . . . sees, outside of himself, and his own party, but three things in all the world: namely, the infinite expanse of the frozen plain, the infinite dome of the cold blue sky, and the cold white sun--nothing but these. The traveler, too, across this frozen desert knows that at no time during his journey are the highest rocks of the mountain summits below him nearer than from one thousand to five thousand feet down through the mighty blanket of snow. Such is the interior of Greenland . . . (Peary, 1898, p. xxxiv).

Nothing has changed in interior Greenland during the sixty years since Peary introduced the American people to Arctic exploration. His enthusiasm for his subject matter led him to wax poetic on its details, and since this paper may otherwise lack in vividness, space can be allowed for his description of the potential hazards and trials of the Arctic summer. First, however, is a list of what these can include:

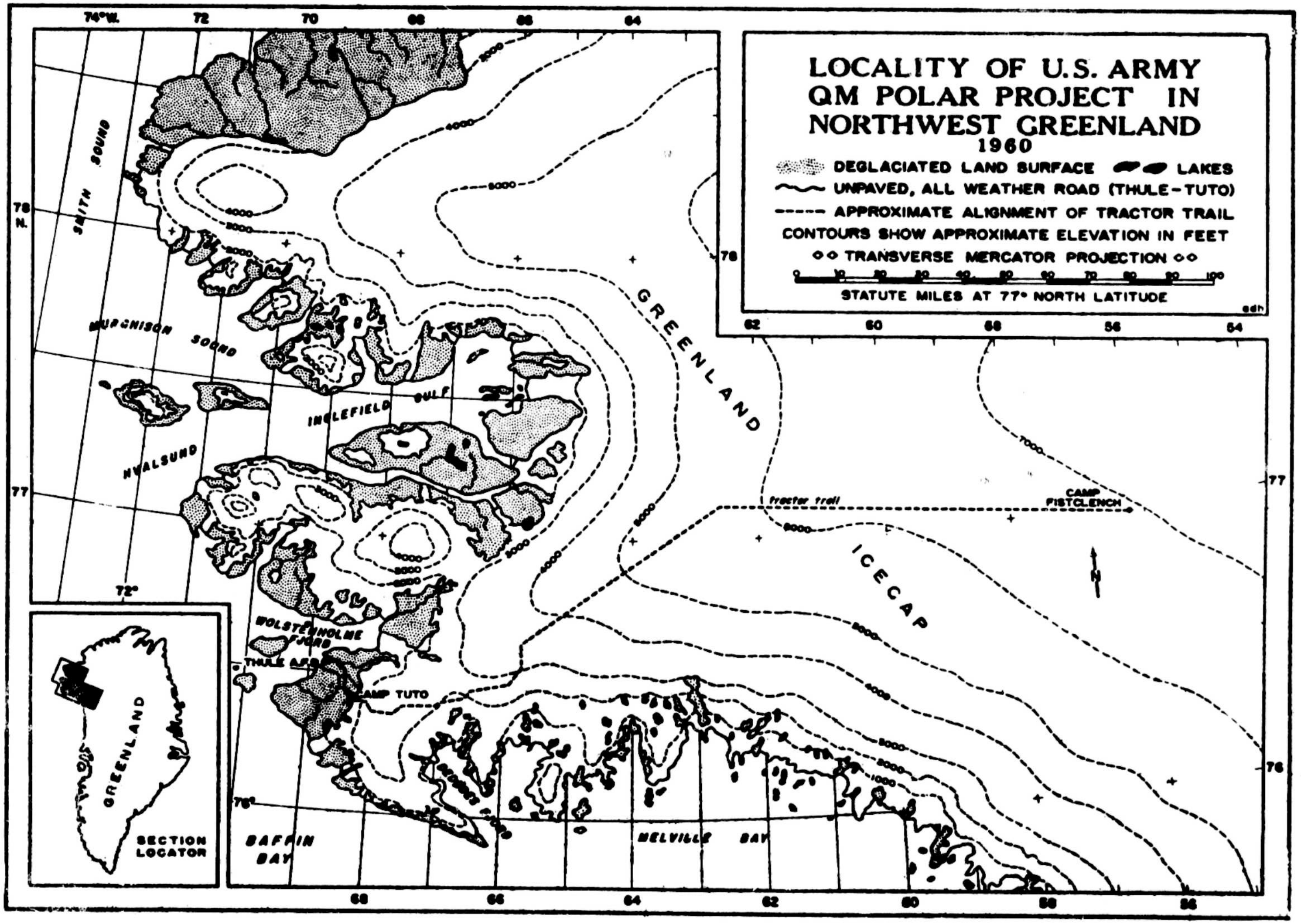
LOCALITY OF U.S. ARMY
QM POLAR PROJECT IN
NORTHWEST GREENLAND
1960
DEGLACIATED LAND SURFACE
LAKES
UNPAVED, ALL WEATHER ROAD (THULE-TUTO)
APPROXIMATE ALIGNMENT OF TRACTOR TRAIL
CONTOURS SHOW APPROXIMATE ELEVATION IN FEET
TRANSVERSE MERCATOR PROJECTION
STATUTE MILES AT 77° NORTH LATITUDE
GREENLAND
ICECAP
tractor trail
CAMP FISTCLENCH
CAMP TUTO
THULE AFB
WOLSTENHOLME FJORD
INGLEFIELD GULF
MURCHISON SOUND
SMITH SOUND
HVALSUND
BAFFIN BAY
MELVILLE BAY
SECTION LOCATOR
74°W.
78 N.
77
76

Fig.--3

a) Cold

b) Monotony of terrain

c) Monotony of food

d) Isolation

e) Windchill

f) Wind constancy

g) Chapping and frost on nose and beard

h) Constant sun; lack of night

i) Snowblindness

j) Tedious water preparation

k) Elevation and oxygen scarcity

l) Ubiquitous hoar frost inside and outside tents

m) Whiteouts

n) Blizzards

o) Soft, soggy snow

p) Cramped quarters in tents

q) Slave work.

Crevasse dangers are not listed because these appear only within 50 miles of the edge of the Icecap. Now, to return to Peary:

> A very important peculiarity of the Icecap is the intensity of the light. My journeys across the "Great Ice" have been made during the Arctic summer--that is, during the time that the sun is constantly above the horizon throughout the twenty-four hours, for a period of some four months. The Arctic sun in clear weather is as brilliant as the sun of any Southern latitude, and when this brilliancy is increased by reflection from an interminable, and absolutely unrelieved, glistening white surface of snow, lifted into the highly rarified and pure upper strata of the Arctic atmosphere, the intensity of light is something that can be realized only by one who has actually experienced it. The pungent quality of this blinding glare is such that the strongest eye can endure it unaided only for a few hours. A man placed in the center of the "Great Ice," in midsummer with no means of protecting his eyes, would be as completely helpless at the end of a day as a blind kitten.

On the stresses of wind, he continues:

> . . . The wind is never quiescent on the "Great Ice." Day and night, summer and winter, year in and year out, it is sweeping down, sometimes with greater, sometimes with less velocity, from the frozen heart of the "Great Ice," bearing with it a burden of snow . . . . As the wind increases in force, the particles of snow become coarser and the depth of the current of flying snow increases until, in the savage blizzards of the frozen Sahara, this drift becomes a roaring, hissing, blinding, suffocating Niagara of snow, rising hundreds of feet into the air . . . (*ibid*., p. lxviii ff.).

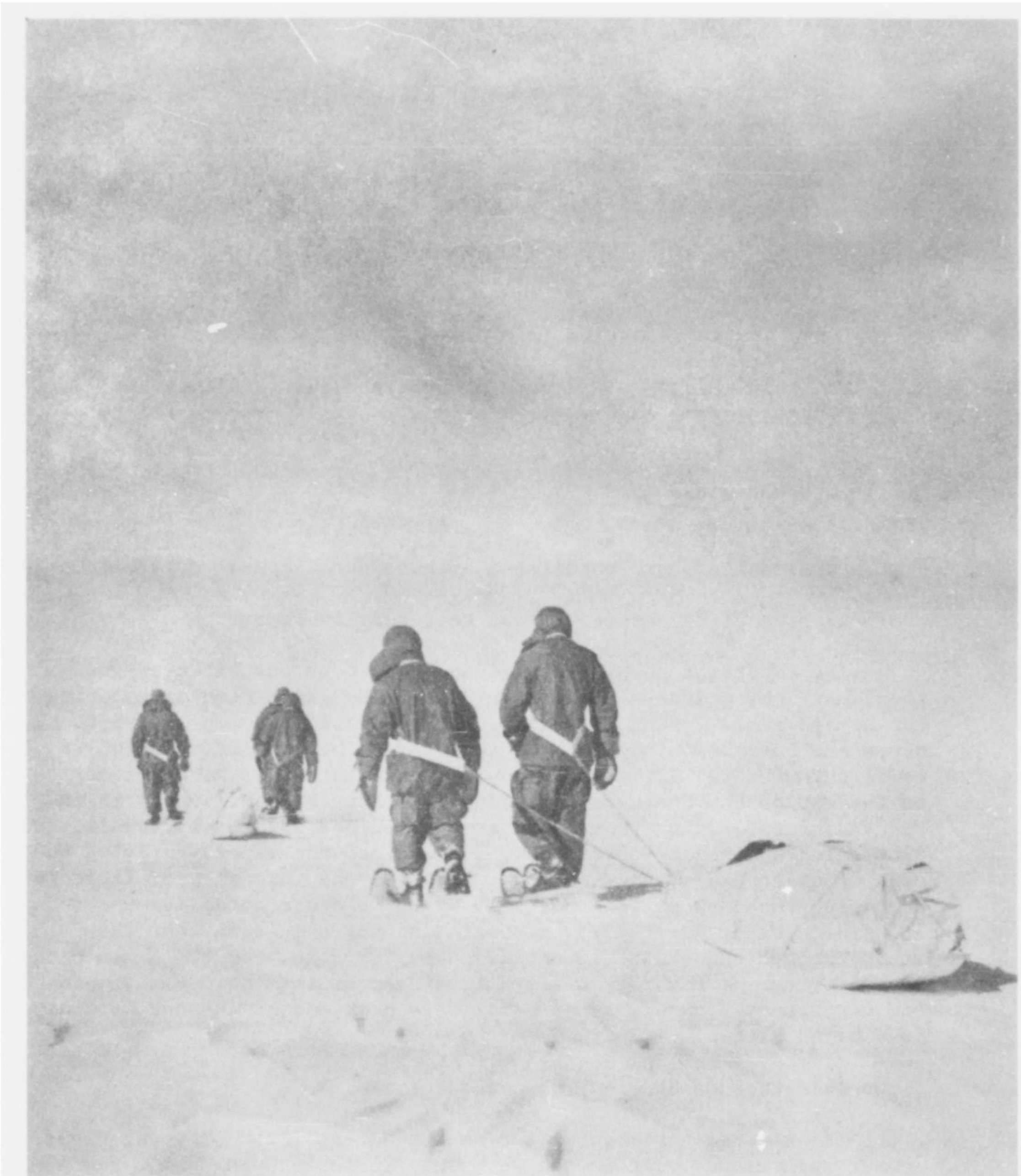

Fig. 4.--Heading east downwind with packs on sleds

Fig. 5.--Returning westward towards base camp with packs on the men's backs

In regard to these and other stresses not elaborated upon, it should be noted that test operations were to cease promptly if environmental conditions became even moderately hazardous. If heavy snow was encountered early in the test, the teams would not be compelled to attain their daily goal of eight miles of travel; if at the end of a cycle the men did not succeed in returning to base, they were to be transported back by snow train. They were not to be told this in advance, however, or otherwise encouraged to lag in their progress.

This description of expected details of the experimental setting can be closed with some statistical data. The mean daily temperature in July ranges from 10° F. to 25° F.; in August it is usually slightly colder. Snowfall averages an inch per week. The wind velocity averages 10 to 13 m.p.h. Elevation of the terrain around the test site ranges from 6500 to 7000 feet. The terrain is nearly flat; other than wind drifts (sastrugi) a few inches high, the only variation is that of gradual sloped which may rise or decline ten feet in a mile. The sun does not touch the horizon until late August. Radio communication is unreliable between stations as little as ten miles apart. With the exception of radio towers, test equipment, oversnow vehicles, markers on the trail leading to the coast, and mounds of snow covering under-ice quarters, there are no landmarks. The isolation provided allows study of psychological and social phenomena under conditions approaching that of the laboratory.

The Test Pattern and Confounding Relationships

The test design specified 4 five-man teams undergoing a sequence of treatments systematically varied within the context of man-hauling across the Icecap. These five-man teams were combinations of two- and three-man subgroups, four of them including NCO's or acting NCO's (leader subgroups) and four without NCO's (follower subgroups). The four leader subgroups can be contrasted in terms of the first two compared with the second two (S_1) and the first and third compared with the second and fourth (S_2). The four follower subgroups similarly can be classified in terms of the first two _vs._ the second two (G_1) and the odds _vs._ the evens (G_2). Also, the four test periods on the trail could be classed by the first two _vs._ the second two (t_1), and the first and third ("going out and down") _vs._ the second and fourth ("coming back and up") (t_2). In each of these cases their "interaction" (i.e., S_1S_2; G_1G_2; or t_1t_2) represents the contrast of first and fourth _vs._ second and third.

The pattern of "which of the two-man subgroups with leaders were to be coupled to which of the three-man subgroups without leaders during which phases?" is expressed by the relationships $I \equiv S_1G_1 \equiv S_2G_2t_1$.

The pattern whereby the experimental treatments were to be applied to the teams and subteams over time is expressed by the relationships $I \equiv S_1t_1R \equiv S_2t_2T$, where R stands for the half _vs._ full ration variable and T stands for the packs-on-back _vs._ packs-on-sleds variable.

These four relationships provided the framework of the one-sixteenth replicate design represented diagrammatically on the following page.

Measures

In a sense, multiple experiments were conducted. One experiment was the situation-as-a-whole, which called for men moving in small semi-isolated groups on foot over the Icecap while under coordination by a

TABLE 1

BASIC SCHEME FOR EXPERIMENTAL TREATMENTS

Cycle I

Teams	A		B		C		D	
Subgroups	a'	a''	b''	b'	c'	c''	d''	d'
Individuals	1* 2 4	5 6	7 8 9	11 12*	13* 14	16 17 18	19 20 21	23 24*
Control Phase - Final Conditioning	Field exercises		Field exercises		Field exercises		Field exercises	
Phase 1 - Outbound Trek	4800 calories packs on sleds		4800 calories packs on backs		2400 calories packs on sleds		2400 calories packs on backs	
Phase 2 - Inbound Trek	4800 calories packs on backs		4800 calories packs on sleds		2400 calories packs on backs		2400 calories packs on sleds	

Cycle II

Teams	A'		B'		C'		D'	
Subgroups	a'	b''	a''	b'	c'	d''	c''	d'
Individuals	1* 2	7 8 9	4 5 6	11 12*	13* 14	19 20 21	16 17 18	23 24*
Control Phase - Final Conditioning	Field exercises		Field exercises		Field exercises		Field exercises	
Phase 3 - Outbound Trek	2400 calories packs on sleds		2400 calories packs on backs		4800 calories packs on sleds		4800 calories packs on backs	
Phase 4 - Inbound Trek	2400 calories packs on backs		2400 calories packs on sleds		4800 calories packs on backs		4800 calories packs on sleds	

*This man is a team leader. Numerical identifications were arbitrarily assigned to individuals. Subgroups with single primes are leader subgroups. Subgroups with double primes are follower subgroups.

central staff. This social and physical experience itself could be expected to produce changes in the values, behavior, and physiology of the test subjects. Among pertinent factors in this context were the development of strengths and skills, of stable patterns of relationships between each team and the central staff, and of relationships between teams; for example, teams holding positions closest to the trail were considered by others to be favored by the central staff.

A second experimental frame was the formal phasing of ration inputs and work loads, which constituted the major focus of the project. A third level of discourse included a series of psychological experiments within test phases, aimed at studying vicarious relief of hunger; data from these experiments have been reserved for presentation in another report and are not discussed in this paper. A fourth level of discourse was microscopic and concerned the day-to-day events during the experiment and the short-term effects these produced.

On each of these levels, a variety of measures were taken. Some of them verified supposed characteristics of the independent variables (e.g., food intake, energy demands of tasks); others related to effects of the experimental treatments on subjects' physiology, phenomenological experience, and social organization.[6] Some of the measures were quantitative and observational; others necessarily were subjective and attitudinal.

Following is an outline of what measures were taken when during the course of the experiment.

---

[6]Measures of intellective capacity and psychometer performance of subjects undergoing the experimental treatments were not taken, both because these variables were rather thoroughly studied in the Keys et al. (1950) experiment and because equipment and time required for such measures would have unduly burdened the facilities of the test operations.

1. Prior to team formation and prior to movement to site, test subjects completed

a) Edwards Personal Preference Schedule (fifteen scales)

b) Thurstone Temperament Schedule (seven scales)

c) Minnesota Multiphasic Personality Inventory (nine scales).

2. Before team formation but after movement to test site, and also after completion of the experiment, subjects completed a questionnaire with questions on

a) Authoritarianism (an eight item scale)

b) Sociometric choices from among all twenty test subjects, of those four individuals who were:

(1) Good judges of materiel
(2) Most desirable teammates
(3) High individual performers
(4) Low individual performers
(5) More affectionate and friendly
(6) Less affectionate and friendly
(7) Most quiet
(8) Most talkative
(9) Most popular
(10) Most similar to self
(11) Least similar to self
(12) Least known to self

c) Level of interest in the test

d) Family background characteristics and military status (pre-operation questionnaire only).

3. During personal debriefing interviews, after team dissolution following completion of the experiment, subjects were asked to make

a) Comparison of two groups of which subject was a member, in terms of

(1) Talkativeness
(2) Bossing
(3) Good feeling
(4) Organization of tasks
(5) Leadership strength

b) Comparison of various daily tasks in terms of

(1) Difficulty
(2) Personal preference
(3) Importance
(4) Appropriateness for leader

c) Identification of role-occupants in two groups of which subject was a member

(1) Most task-oriented
(2) Humorist
(3) Least helpful
(4) Laziest
(5) Preferred co-worker
(6) Communicator to staff

d) Comments on comparisons of styles of organization of groups

(1) Leader-organization vs. democratic organization
(2) Collective application to single tasks vs. division of and specialization

e) General comments on experiences.

4. During test phases of the experiment, the staff made

a) Rankings of all individuals in terms of

(1) Depression and listlessness
(2) Physical fitness
(3) Integration as team member
(4) Irritability
(5) Acceptance of (resistance to) test
(6) Neatness, orderliness
(7) Talkativeness
(8) Sharing, generosity

b) Observations of daily working relationships

(1) Pairing on man-hauling sleds
(2) Location of personal space in tents
(3) Allocation of trench space during noon break
(4) Pace on trail
(5) Lead and lag of teams along line of march
(6) Allocation of routine daily tasks
(7) Observed talkativeness during daily march
(8) Apparent apathy, weakness, depression, insubordination
(9) Hostility
(10) Evaluation of "polish" of routine daily tasks (team performance)

c) Physiological measures

(1) Daily intake of food and water
(2) Physical fitness (Harvard Step)
(3) Water balance
(4) Body weight
(5) Sodium and potassium in urine
(6) Energy expenditure (respiration) during work

d) Records of sick call

e) Records of data from psychological sub-experiments conducted within test phases (responses to problems)

f) Informal tape-recorded interviews in evenings in tents on phenomenology of hunger and other test aspects.

5. In each experimental phase, subjects provided questionnaire data relating to

a) Sociometric rankings or ratings of team members in terms of

(1) Weight and influence in team
(2) Work with most closely
(3) Performance
(4) Liking
(5) Preference as future team co-members
(6) Sympathetic behavior

b) Comments on gripes, complaints, and sources of intra-team arguments as well as "liked" aspects of test activities

c) Ratings by subjects of individual staff administrators and scientists in terms of

(1) Power
(2) Likeableness
(3) Dominance

d) Subjective ratings of

(1) Hunger
(2) Talkativeness in teams, and laughter
(3) Time-sense
(4) Mental activity, fantasy

(5) Physical ailments (chapping, feet overheating)
(6) Cold
(7) Tiredness
(8) Good feelings toward and respect for teammates and toward team
(9) Team performance
(10) Thirst
(11) Irritability, selfishness
(12) Personal uncleanliness
(13) Sex
(14) Various social characteristics of teams
(15) Sleeping and work conditions in teams
(16) Oral activity (smoking, gum)

e) Allocation of team-members to various task-role positions

f) Ratings of individual food items in the various menus, in terms of liking, monotony, appropriateness.

Only a segment of the data generated in the experiment can be dealt with in this report. More than 150 variables were quantitatively measured. Though some measures were replicates, the data include too many discrete dimensions to be handily encompassed within a single conceptual framework. Each of the dependent measures not only can be related to the independent variables but also may relate to other dependent variables. To delimit the scope of evidence considered here, the independent and dependent variables have been placed in subcategories from among which only certain combinations have been selected for present consideration.

In addition to the three main variables in the major experiment (ration level, task difficulty, and successive experimental phases over time), certain sub-experiments were performed within the experimental phases. These sub-experiments, testing ways to reduce subjective hunger, are not dealt with here.

Certain standard questionnaires were administered to subjects during the two control phases preceding the two experimental cycles. These were aimed both at familiarizing subjects with the questionnaires and at obtaining baseline data on subjective stress and team structure attributes prior to the subjects' undergoing the stresses of the experimental phases. Contrast of these baseline data with subsequent experimental data was not provided for in the experimental design of the major experiment and will be reserved for discussion elsewhere.

Another set of data, obtained prior to inception of the control and experimental phases of the experiment, referred to characteristics of the subjects themselves, both as self-reported on personality inventories (MMPI, Edwards PPS, Thurstone Temperament Schedule) and as reported by subjects' peers on the pre-experimental sociomentric questionnaire. The relationships between these personality data and subsequently-obtained data on individuals' reactions to experimental conditions form the basis of a third planned report dealing with personality factors.

Yet another report or series of reports will be specifically concerned with analysis of relationships between the physiological measures obtained and effects of the major independent variables on these measures. Therefore, only passing mention of physiological data will be made in the present report, to substantiate the presumed effects of the task and time variables on physical output demands made upon the men.

During the experimental phases of the test a close reckoning was kept on the different food items issued to the subjects and the proportion of issued quantities which they consumed. At the same time, subjects' hedonic preferences for these different items were also periodically obtained, together with information on subjects' ideas about (a) items needed but missing from the rations, (b) monotonous items, (c) items causing gastric disturbance, or (d) items unnecessarily abundant in the rations. In another report, changes in patterns of consumption of issued items at different test phases and under different ration levels are related to preference ratings for these items and to the frequency with which items are named as monotonous, satiating, excess, or unnecessary.

The present report, then, deals with only a fraction of the relationships and contrasts generated by data on the more than 150 quantitative variables studied before, during, and after the experiment. The intent here is to present findings on reported hunger-related experiences of individuals and social effects of being hungry.

CHAPTER IV

RESULTS

Objective Measures Confirming Characteristics of the Independent Variables

The full-ration team members were issued approximately 4800 calories daily, while low-ration team members received half this amount of rations. Subjects were not, however, required to eat all food issued. Table 2 shows the daily average caloric intake of team members during the four experimental phases of the test. The word "reportedly" appears in the table title because collection of the data required cooperation from the subjects. Food issued was ordinarily eaten directly from containers. Each day each subject repacked all containers in a given day's ration, both opened and unopened, back into the ration boxes for turn-in at the time of issuance of the next day's rations. The difference in gross weight of each container of each item issued to and returned by each individual was used to estimate consumption of that item. Then the caloric consumption of each item by each individual on a given day was summed to obtain a measure of daily caloric intake. Subjects would have preferred to toss aside or bury used containers, so considerable pressure had to be put on them to assure their cooperation in saving used containers for turn-in. In rare instances when containers were lost or thrown away instead of being turned in, consumption of those items was estimated for the individual concerned as the average consumption of the items by others in his team.

TABLE 2

AVERAGE DAILY CALORIES REPORTEDLY CONSUMED BY TEAM MEMBERS DURING EXPERIMENTAL PHASES

Teams	Cycle I			Cycle II		
	Phase 1	Phase 2	Average	Phase 1	Phase 2	Average
A	3241	3974	3607	2332	2321	2326
B	3382	3602	3492	2360	2388	2374
Average	3311	3788	3550	2346	2355	2350
C	2261	2384	2323	4011	3948	3980
D	2303	2364	2333	4219	4445	4332
Average	2282	2374	2328	4115	4197	4156

Other possible factors affecting estimates of caloric consumption were trading, waste, and theft. As all men were issued the same foods, benefits of trading were reduced; nevertheless a little trading no doubt took place. In some teams canned mean items were occasionally pooled to make a "stew" in canteen cups. Probably uneaten excess, if any, of these melanges was thrown away rather than returned to containers for turn-in. There were also a few known instances of "borrowing," food-stealing, and smuggling. Early in the first cycle, one or two members of low-ration teams attempted to contact buddies in full-fed teams to obtain uneaten remainders of the latters' rations; however, growing inter-team hostility and administrative action put a quick stop to this practice. Before the beginning of the second cycle, teams previously well-fed exerted many efforts to smuggle food in their packs and gear so as to ameliorate anticipated effects of undergoing the low-ration treatment.

Shakedown inspections thwarted most of these endeavors, but some food is known to have escaped in the inspections. Also in the second cycle there was known disappearance of food from a storage area. This might be attributable to action taken by subjects.

Data in Table 2 indicate a 1200-calorie difference between average daily intake of high-ration and low-ration subjects in the first cycle. The difference is greater in the second phase of this cycle than in the first; subjects on full rations during the first cycle apparently became accustomed to the rations and ate more of them to replace energy expended during trail marching. In the second cycle full-fed subjects ate with gusto, and accordingly the second-cycle difference in average daily intake between the two ration levels is six hundred calories greater than in the first cycle. However, the average caloric deficit of teams on low rations might be placed at approximately 1500 calories if (a) the possible excessive intake of high-ration subjects in the second cycle is somewhat discounted; (b) some account is taken of the illicit food consumed by some low-ration subjects in the second cycle; and (3) intake of subjects on the high-ration level in the second phase of the first cycle is taken as more realistic than their intake in the first phase of that cycle.

The second major independent variable was task difficulty. One system of trail marching required subjects to place their individual rucksacks (containing personal gear, sleeping bags, daily rations, and the like) on one of the two sleds hauled by a team, while the other sled held team gear (tent, stove, lantern, shovels, etc.). Under the other system, individual rucksacks were carried by the subjects on their backs, while group gear was distributed between the two sleds. The data in Table 3 show that, as expected, the latter system was more costly in energy requirements. Also suggested is a slightly lower average energy expenditure rate among the underfed subjects.

TABLE 3

ENERGY EXPENDITURE RATES OF TEAMS TRAIL-MARCHING IN THE SECOND CYCLE[a] (AS MEASURED BY AIR INTAKE)[b]

Condition	Team	Phase 1	Phase 2	Average
Low rations	A	16.2[c]	14.0[d]	15.1
	B	18.5[d]	13.4[c]	15.9
	Average	17.3	13.7	15.5
High rations	C	16.3[c]	15.1[d]	15.7
	D	17.7[d]	14.5[c]	16.1
	Average	17.0	14.8	15.9
Packs on sleds	Average	16.2	14.0	15.1
Packs on backs	Average	18.1	14.6	16.3
All conditions	Average	17.1	14.3	15.7

[a]Malfunction of respirometers prevented accumulation of comparable first-cycle data.

[b]These data were supplied by Dr. M. Krieder, Physiology Section, Quartermaster Research and Engineering Command, Natick, Massachusetts. Their reliability is appraised in a report by him; a one-unit difference in averages is likely to be statistically significant. Units are O_2(cc)/min/kg body weight; one unit is roughly equivalent to half a calorie of energy expenditure per minute by a 150-pound man.

[c]Packs on sleds.

[d]Packs on backs.

The remaining two major independent variables were the cycle and phase components of time. Weather characteristics of these periods are shown in Table 4. In contrast to the first ten-day cycle the second cycle had no snowy weather. Temperatures were higher than expected for August (i.e., no lower than those recorded for July) and wind speed estimates averaged half of those in the first cycle.

TABLE 4

AVERAGE NOONTIME WEATHER AND TERRAIN CONDITIONS
DURING FIVE-DAY EXPERIMENTAL PHASES
(OBSERVER ESTIMATES)

Item	Cycle I		Cycle II	
	Phase 1	Phase 2	Phase 1	Phase 2
Temperature	17° F.	17° F.	17° F.	16° F.
Wind direction	Easterly (favorable)	Easterly (unfavorable)	Easterly (favorable)	Easterly (unfavorable)
Wind speed (mph)	18	18	10	9
Days with precipitation (snow)	2	0	0	0
Clear days	2	5	3	2
Snow cover	Moderately hard crust with shallow drifts	Moderately hard crust	Extremely hard crust	Very hard crust

The first ("outbound") phase of the trek in each of the two cycles could be regarded as downhill because the elevation dropped on an average of a few feet in a mile as the subjects moved from their base camp out along the trail leading to the coast. The first phase in each cycle could rightly be called

Fig. 6.--Recording air intake as metered at the nozzle of the respirator mask

Fig. 7.--Weighing back-carried packs served as a restraint against the men's packing them only half full.

the "downhill" leg of the trek also because prevailing winds at the test site were regularly from the east or thereabouts. Marching against these winds on the return leg seemed like walking uphill. Despite this handicap, however, second-cycle respiratory data (Table 3) show a lower energy expenditure by subjects during the return leg in the second phase of this cycle. The reduction can be attributed perhaps to greater team efficiencies plus reduced metabolic rates among subjects adapting to costs of the environment. This effect of adaptation, coupled with the fact that wind speeds were low in the second cycle, suggests that energy expenditures of subjects in the first cycle were considerably higher.

Evidence of the effects of wind and weather (as well as of acclimation over time) on subject group performance is provided by data on the paces which teams maintained as they moved over the Icecap. At 11:00 A.M. on most of the days during the experimental phases, observers timed by stopwatch the interval required by each team to take 100 steps. As criteria of "team pace," the steps of one or (more usually) two men in each team were timed. The identity of timed individuals as well as their trail positions within teams, was varied systematically over successive days; however, the paces of men in the "trail-breaker" position were not timed.

The data are shown in Table 5. Blank cells indicate occasions when observations were not made or were not completed. Where two individuals in a team were timed on the same day, their paces have been averaged in the table into a single entry for that team on that day.

TABLE 5

TIME IN SECONDS REQUIRED BY REPRESENTATIVE INDIVIDUALS IN TEAMS TO MARCH ONE HUNDRED PACES

Team	Cycle I												
	Phase 1 days						Phase 2 days						Cycle Avg.
	1	2	3	4	5	Avg.	6	7	8	9	10	Avg.	
A	..	68	72	78	..	73	76	80	78	71	80	77	75
B	..	70	72	69	..	70	66	74	65	68	68	68	69
C	..	68	82	79	62	73	76	68	76	75	68	73	73
D	..	62	69	68	62	65	73	78	80	77	78	77	72
Avg.	..	67	74	74	62	70	73	75	75	73	74	74	72
	Cycle II												
	Phase 1 days						Phase 2 days						Cycle Avg.
	11	12	13	14	15	Avg.	16	17	18	19	20	Avg.	
A'	62	65	68	68	65	66	..	70	66	70	65	68	67
B'	68	64	60	66	64	64	..	68	60	70	60	65	64
C'	58	..	65	72	58	63	..	74	70	70	68	71	67
D'	58	..	67	64	58	62	..	65	64	72	64	66	64
Avg.	62	65	65	68	61	64	..	69	65	71	64	67	66
	Both Cycles												
	Phase 1 days						Phase 2 days						Both Cycles Avg.
	1st	2nd	3rd	4th	5th	Avg.	1st	2nd	3rd	4th	5th	Avg.	
Avg.	62	66	69	71	62	67	73	72	70	72	69	71	69

Fig. 8,--An overcast day

Because teams were required to guide on each other to avoid excessive spread between teams along the line of march, there is relatively little variation of pace between teams within cycles. Necessarily, underfed teams marched as fast or as slowly as full-fed teams. Generally the pace was slow; a median pace of 68.6 seconds for one hundred paces for the data in Table 5 can be contrasted with the normal military rate of march (on solid ground) of 120 steps/minute. There was, however, considerable variation in pace between cycles and between phases within cycles. The pace considerably quickened in the second cycle in accordance with the favorable weather conditions in this cycle described above; the median test applied to the inter-cycle difference produced a corrected χ^2 value of 9.9, significant at the .01 level. On the other hand, the pace in the second phases slowed when the subjects had to face the wind and gradual rise in terrain; a corrected χ^2 value of 7.1, significant at the .01 level, is obtained from application of the median test to the inter-phase difference in pace. That the reduction in pace during second phases may have been an overcompensation for added difficulties of marching is suggested by the Cycle II respiratory data in Table 3, which represent subjects as expending less energy in the second phase than in the first.

Subjective Non-Social Effects of the Variables

Confirmatory effects

The supposition that subjects had to work less in the second cycle is supported by data on their sense of fatigue and weariness during the experimental phases of the test. Mean responses to four questions relating to fatigue and weariness on three different questionnaires administered at different times are shown in Table 6.[7] The data show a decline in average subjective

TABLE 6

RESPONSE VALUES ON A SEVEN-POINT SCALE TO FOUR QUESTIONS* RELATING TO FATIGUE

Analysis of Variance

Source of Variation	d.f.	Mean Square	F	Significance Level
Questions (Q)	3	7.6281	7.40	.001
Subjects (S)	19	7.2886	7.07	.001
Periods (P)	3	10.8031	10.48	.001
QS	57	1.9593	1.90	.001
QP	9	1.4392	1.40	. .
SP	57	3.1869	3.09	.001
Residual	171	1.0306	. .	. .

Mean Values

Cycle	Phase	Question 1	Question 2	Question 3	Question 4	Avg.
I	1	5.00	5.40	4.70	5.75	5.21
	2	4.80	5.65	5.55	5.30	5.33
II	1	4.35	4.80	4.50	4.85	4.63
	2	4.10	4.65	4.70	5.15	4.65
Average		4.56	5.13	4.86	5.26	4.95

*1. Questionnaire A, Item 6-6 (Appendix Table 31)
2. Questionnaire B, Item 6-2 (Appendix Table 32)
3. Questionnaire C, Item 1A-6 (Appendix Table 33)
4. Questionnaire C, Item 15-1 (Appendix Table 34)

fatigue between the two successive cycles. Analysis of variance shows that this decline is consistent among the four different questions relating to fatigue (i.e., there is no significant Time Period-Question interaction). There can be little question that subjects found the going easier during the second cycle.

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[7]Tables appearing in the tabular appendix (Appendix C) are referred to in the text as Appendix Tables.

Table 7, summarizing reports on chilling, suggests that especially in the first phase of the second cycle, when subjects encountered light, favorable winds, and night temperatures were not yet below zero, the energy expenditure for body warmth may have been minimal. Response data to a question on subjects' level of annoyance and irritation with the weather (see Appendix Table 23) similarly show a significant drop between the first and second cycles.

TABLE 7

RESPONSE VALUES ON A SEVEN-POINT SCALE
TO TWO QUESTIONS* RELATING TO COLD

Analysis of Variance

Source of Variation	d.f.	Mean Square	F	Significance Level
Questions (Q)	1	7.2250	5.29	.05
Subjects (S)	19	7.7158	5.64	.001
Periods (P)	3	4.4833	3.28	.05
QS	19	1.7776	1.30	. .
QP	3	0.7083	< 1	. .
SP	57	1.8692	1.37	.05
Residual	57	1.3662	. .	. .

Mean Values

Cycle	Phase	Question 1	Question 2	Avg.
I	1	4.35	4.45	4.40
	2	4.10	4.55	4.33
II	1	3.50	3.90	3.70
	2	4.00	4.75	4.38
Average		3.99	4.41	4.20

*1. Questionnaire A, Item 6-2 (Appendix Table 39)
2. Questionnaire B, Item 6-6 (Appendix Table 40)

These evidences combine to suggest that energy deficits of men in the first cycle were greater than the deficits of men in the second cycle, due to milder weather and to adaptation to the test environment and test conditions.

With greater energy demands on them in the first cycle, subjects--especially those on short rations--should have been hungrier than in the second cycle. Evidence of statistically-significant shifts in subjective hunger over time is shown in Table 8. Evidently subjects were somewhat less hungry in the second cycle. Adding to the face validity of these data was the increase in average reported hunger between successive phases within cycles.

TABLE 8

RESPONSE VALUES ON A SEVEN-POINT SCALE
TO FOUR QUESTIONS* RELATING TO HUNGER

Analysis of Variance

Source of Variation	d.f.	Mean Square	F	Significance Level
Questions (Q)	3	3.2281	3.86	.01
Subjects (S)	19	7.5452	9.02	.001
Periods (P)	3	7.0115	8.38	.001
QS	57	2.3882	2.86	.001
QP	9	2.3281	2.78	.001
SP	57	5.5838	6.68	.001
Residual	171	0.8362	. .	. .

Mean Values

Cycle	Phase	Question 1	2	3	4	Avg.
I	1	5.50	4.85	5.50	5.35	5.30
	2	5.75	5.35	5.70	5.85	5.66
II	1	4.65	4.70	4.90	5.65	4.98
	2	4.80	5.20	5.65	4.85	5.13
Average		5.18	5.03	5.44	5.43	5.27

*1. Questionnaire B, Item 6-4 (Appendix Table 24)
2. Questionnaire C, Item 1A-8 (Appendix Table 25)
3. Questionnaire C, Item 15-2 (Appendix Table 26)
4. Questionnaire A, Item 6-4 (Appendix Table 27)

Since the primary purpose of this study was to examine subjective and social effects of hunger, it was necessary to demonstrate that the subjects were in fact more hungry when undergoing the reduced rations condition. On 2400 calories daily, they should have been: Lindsay (1935, p. 81) in a comparable situation reported that "It did not take us more than a day to realize that we were ravenously hungry on 26-1/4 oz. [= approx. 3600 calories] per diem. Food filled our thoughts and dreams, but not our stomachs . . ."

Subjective hunger was asked about in questions appearing on each of the several questionnaires administered at different times within test phases of the present study. Obtained hunger ratings are summarized in Appendix Tables 24 through 27. The expected large difference in average ratings of subjective hunger between full-fed and underfed subjects clearly emerged. Analyses of variance of these data (shown in the same Appendix Tables) confirmed the reliability of this observed difference. Generally, all subjects reported themselves at least moderately hungry, and underfed subjects tended to feel a very high level of hunger. The tables also show in detail the general trend of decreasing hunger between cycles and increasing hunger within cycles.

Enjoyment of food

Throughout the course of the experimental phases, subjects were asked to rate enjoyment of food items in the C-ration menus they were receiving. While these data were obtained primarily to study monotony characteristics of specific items, the ratings were examined to see how in general the experimental treatments affected obtained ratings. In this analysis, ratings of the first nine food items, arbitrarily selected from among the more than fifty items periodically rated, were averaged for each subject in each experimental phase, and analysis of variance was performed on these mean ratings (see Appendix Table 28).

The saying "hunger makes the best sauce" is supported by the data. Subjects under low rations rated foods reliably higher than did subjects under full rations. Further, there was a slight (not statistically reliable) trend toward increase in expressed liking for the food during successive phases. These trends support impressionistic data from observers in the Minnesota study (Keys *et al.*, 1950, p. 833) but are contrary to evidence in another study (Army Medical Nutrition Laboratory, 1953) in which overt rebellion took place against continued eating of controlled amounts of canned ration items.

Sexuality

The literature on underfeeding includes many mentions of changes in sexuality resulting from low energy input. It is clear that under long-term deprivation glandular activity of the gonads decreases and there may be actual shrinkage of the organs (Keys *et al.*, 1950, p. 839; Benedict *et al.*, 1919). Evidence on sexuality under short-term deprivation is less clear-cut; at least one observer (Lindeman, 1958, p. 131) has indicated that sexuality may at first increase during earlier stages of deprivation. Ruff and Levy (1959) report that groups of five men confined in isolation for five days developed preoccupations with phallic sexuality and excretory functions during the second to fourth days. Eren (1954) reports comparable phenomena among men confined in a submarine. Bondy (1943) asserts that "the everlasting talk of sex and smut may be considered as compensatory satisfaction," and Castro (1952, p. 70) agrees with this interpretation.

Data from the present study (Appendix Tables 29 and 30) support the latter assertion partly in that subjects tended to report high concern with sex, especially in earlier phases of the experiment. However, the only trend appears entirely due to effects of time and appears not related to feeding or task conditions. The evidence suggests that any increased sexuality which might be felt initially by persons undergoing underfeeding might well be a reaction to general stress rather than a result of specific effects of decreased food input.

Fatigue

One other subjective feeling about which the men expressed high concern was fatigue. Detailed data on subjects' responses to four direct questions on fatigue are shown in Appendix Tables 31-34. All four sets of data show a significant rise in fatigue ratings when subjects were underfed. This finding supports the general conclusion of earlier studies that hunger brings lassitude and weakness (Keys et al., 1950, pp. 680, 706, 828, 936 ff; Benedict et al., 1919, passim; Dyme, 1950).

Second-cycle respirometer data (Table 3) indicated that the subjects had to work harder when carrying packs on their backs than when packs were hauled on sleds. Generally the detailed data on subjective fatigue, shown in the Appendix Tables 31-34, failed to reflect this difference between the two task procedures. A reliable increase in fatigue responses under the back-carrying condition appeared only for one question (Appendix Table 34). These data also show a Rations-Task interaction such that the added fatigue under the back-carrying condition is more apparent to underfed subjects. The failure of other items on fatigue to elicit responses differentiating between the two task conditions may be attributable to the general difficulties which all subjects encountered in the fatiguing first cycle; these may have been so great as to suppress differences in fatigue which might be attributable to manner of transporting packs. Conceivably, if first-cycle respiratory data were available, they too would not show a difference in effort required by the two tasks.

Fatigue effects of the experimental variables (food intake and pack-carrying) can also clearly be seen in subjects' ratings of the difficulty of the three trail positions within teams: trail-breaking (one man), hauling first sled (two men), and hauling second sled (two men). The data are shown on Table 9, and Appendix Tables 35-37.[8] All three positions were rated as

TABLE 9

MEAN SUBJECT RATINGS OF LEVEL OF DIFFICULTY OF THREE WORKING POSITIONS IN TEAMS TRAIL-MARCHING UNDER VARIOUS CONDITIONS

Position	Condition					
	Underfed			Full-fed		
	Packs on			Packs on		
	Sleds	Backs	Avg.	Sleds	Backs	Avg.
Trail-breaking	3.55	4.90	4.22	3.30	3.75	3.52
First sled	4.40	4.90	4.65	3.95	4.00	3.98
Second sled	4.40	4.70	4.55	4.40	3.85	4.12
Average	4.09	4.83	4.47	3.88	3.87	3.87

more difficult by subjects when underfed than when full-fed. However, only when underfed did subjects generally report more difficulty with the packs-on-backs task condition as compared with the packs-on-sleds task condition. It seems that hungry men may be sensitive to marginal differences in task difficulty which full-fed men ignore.

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[8]A conjoint analysis of variance of data on these three tables is shown in Appendix Table 38.

Cold

Previous reports on men exposed to low food intake have stressed their sensitivity to cold as compared with full-fed men. A lowering of body temperatures was noted among some of the subjects in the Minnesota experiment on long-term underfeeding; this, say Guetzkow and Bowman (1946, p. 62), . . . "is more serious than it sounds, for it makes the starving very sensitive to cold weather." Informal observation of the Minnesota subjects indicated that they were oversensitive to cold and had a high tolerance of heat (Keys et al., 1950, p. 827).

Three questions in the present experiment were directed at subjects' phenomenological experience of the cold of the environment. The responses (Appendix Tables 39-41), averaging about a scale point below subjects' ratings of fatigue and sexuality, suggest that subjects were less concerned with cold than with the other distresses cited. Further, the data show no systematic increase in subjective cold when subjects were underfed; indeed, responses to one question (Appendix Table 39) show a significant Rations-Phase interaction such that, while full-fed subjects' ratings of cold increased over time, those of underfed subjects decreased. Like the data on subjective sexuality, the subjective intensity with which cold was felt by subjects varied considerably between subjects and between teams, but not between hunger and work conditions. The negativity of these returns is confirmed by subjects' responses (Appendix Table 24) to another question on their concern about the weather in the experimental setting. Generally the data on weather confirm the implication of the data on cold: that perceived intensity of environmental cold stress was independent of food intake and work conditions in this experiment.

<u>Time</u>

We have all heard of time dragging during periods of unpleasantness. Such a turgid comment as "every tortured second seemed like an hour" might not be mere dramatic license. Time estimates rise with boredom, passivity, repetition, etc. (Loehlin, 1959). A study by Schonbach (1958) showed that hungry subjects gave higher estimates of a fixed waiting time interval than did subjects who were not hungry. His finding suggests that his hungry subjects "felt time dragging," although this does not necessarily follow from the difference he reports in subjective time estimates from hungry and not-hungry subjects.

The possibility that underfed men more than fully-fed men in the present experiment might subjectively feel that their working hours passed slowly was investigated by means of a question on the rapidity with which the hour before lunch seemed to go by. The only distinct effect of the experimental conditions which is revealed by the resulting ratings (Appendix Table 42) is that of replicate cycles; the time seemed to pass more quickly for the men in the second cycle. There is no reliable evidence that the more hungry men had a great sense of time dragging, although it is still quite possible that, in the blank and unchanging environment of the test, the hungry men's estimates of an hour might have been chronologically shorter than estimates of full-fed men.

<u>Overheating</u>

Related to the problem of chilling is that of overheating. In Appendix A, Part 2, mention is made of hungry subjects' tendency to march out quickly in the mornings because they reportedly were feeling cold. This quick marching could lead to overheating under the test conditions (LeBlanc, 1961). Three questions were aimed at this possibility (Appendix Tables 43-45). Responses indicate first that overheating was low-rated as a problem by subjects and second that underfeeding did not produce significant direct effects on ratings. Ratings of general overheating declined with passage of time within cycles (Appendix Tables 43 & 44), but ratings of overheating during a specific one-hour time period did not decline. Responses to one item (Appendix Table 43) showed interaction effects such that a drop in within-cycle overheating ratings was evident only among underfed subjects. Other statistical effects suggest that the more energy-demanding task (packs-on-backs) was associated with higher overheating ratings (Appendix Table 45), mostly in the second cycle and among underfed subjects.

Thirst

In the Arctic, when fuel is short, water is short. Even when fuel is ample, water-melting is tedious. Occasional reports (e.g., Military Planning Division, 1951, p. 8) cite thirst as a problem in the Arctic. Subjective thirst of men in the present experiment was investigated by three question items (Appendix Tables 46-48). The average responses suggest that thirst was more of a problem to the men than, say, overheating. However, there was no suggestion that thirst was reliably affected by the ration, time, or task variables, despite the variations in metabolic activity with which these were associated.

Living and housekeeping

Three items on one questionnaire inquired into subjects' annoyance and irritation with water-melting, cooking, and sleeping conditions (Appendix Tables 49-51). Average ratings indicate that subjects were moderately bothered by these aspects of Icecap living, but their concern generally diminished with time (acclimation, growth of skills, etc.). Concern with water-melting and cooking was less (significantly, for the latter activity) when men were on full rations. This ration effect was significantly more evident among men carrying packs on backs (the more arduous task). On the other hand, ratings of concern with sleeping conditions did not vary with ration; the only significant effect emerging from the data was that in the first cycle men in the more arduous task (packs on backs) were bothered less by sleeping conditions, whereas in the second cycle they were bothered more than were men carrying packs on sleds.

Health and hygiene

Do the miseries of hunger enhance other aches and pains, so that hungry men are more concerned about their health than are the full-fed men? Keys *et al.* (1950, p. 691) report not; their subjects in the Minnesota experiment were not acutely apprehensive about their health although they suffered from dizziness and lethargy. One questionnaire item in the present experiment queried subjects on concern about health. Obtained ratings (Appendix Table 52) indicated only moderate annoyance and irritation with health problems. Also, the ratings varied reliably neither with ration level nor with the other experimental variables, although they do suggest greater health concern among underfed subjects and among subjects in the first cycle.

Considerably higher average ratings were given in response to a question on subjects' annoyance and irritation with uncleanliness (Appendix Table 53).

Fig. 9.--After the day's march comes the need for shelter

Fig. 10.--The evening's housekeeping

Fig. 11.--The end of a day

Hungry men tended to average higher ratings, and averages increased with passage of time phases within test cycles (i.e., as the men got dirtier). Here again, however, suggestive differences were not statistically reliable.

Two specific ailments often encountered by men marching in polar regions are skin irritation (chapping and sunburn) and foot trouble. Data in response to questions on these ailments appear in Appendix Tables 54 and 55. Average subjective concern with chapping appeared greater than concern about sore feet. Responses to the two questions followed opposite patterns of variation with the experimental variables, and reasons for the conflicting patterns are not wholly explicable. Concern with sore feet tended to increase between successive cycles but decreased reliably over time within cycles, whereas concern about chapping diminished reliably between cycles, but among the hungry men tended to increase within cycles. Hungry subjects tended to rate their concern with sore feet higher than did full-fed men. Ratings of concern about chapping did not co-vary with pack-carrying method, but men carrying packs on their backs reported reliably more concern with sore feet than did men with packs on sleds.

Going on sick call is included among the forms of absenteeism associated with onset of stress in the work setting (Mellin, 1961; Mechanic and Volkart, 1961), or under conditions of poor adjustment in stressful environments (Eilbert and Glaser, 1959). French (1951) found that, among Naval recruits, sick call was an informally legitimate way to gain temporary remission from training rigors, insofar as "going sick" did not appear to affect subsequent peer group opinion of a recruit. Among trail teams on the Icecap, going on sick call meant more work for teammates and therefore probably somewhat weakened a man's standing in his group. On the other hand, sick call is a time-honored device for evasion in the military and probably retained some permissive sanctioning among the test subjects.

In Table 10 entries from the medical corpsman's sick log are classified by the test variables. Visits to sick call follow a pattern consistent with previously-discussed phenomenological reports of concern with health problems. Men on low rations, and men carrying their packs, put in more

TABLE 10

FREQUENCY OF APPEARANCES AT SICK CALL DURING SUCCESSIVE FIVE-DAY TEST PHASES

Rations	Task	Cycle I Phase 1	Cycle I Phase 2	Cycle II Phase 1	Cycle II Phase 2	Avg.
High	Sleds	3	3	2	2	2.50
High	Backs	9	2	3	. .	3.50
Low	Sleds	8	. .	6	2	4.00
Low	Backs	9	4	5	4	5.50
Average		7.25	2.25	4.0	2.0	

appearances at sick call than did their opposite numbers. The initial phases of both cycles had higher rates than the second phases, and rates were higher in the first cycle than in the second. There is a clear relation between the pattern of sick call visits and the expected pattern of stresses and adaptation.

Summary

Soldiers man-hauling sleds across the Greenland Icecap under test conditions of the QM Project 60-1 reported themselves more or less affected by a number of non-social experiences. Chief among these, according to the subjects, were uncleanliness, sexuality, fatigue, and hunger. Of more moderate concern to them were chilling, health, sleeping conditions, and thirst. Least bothersome to them, according to reports, were chapping and sore feet, overheating, cooking and water-melting, and time-dragging.

Among these concerns, only two--fatigue and trail-marching difficulties, and liking for food--had a definite relationship with level of food input. Level of food input also was very probably related to subjects' sense of physical malaise and sick call rates, as well as to their dissatisfaction with uncleanliness, with sore feet and chapping, and with cooking and water-melting chores. Apparently independent of food input were concerns with sexuality, chilling, and cold, sleeping conditions, thirst, overheating, and time-dragging.

Within-team variances of ratings of non-social experiences fluctuated considerably with the nature of the phenomena rated. Subjects in teams were relatively consistent among themselves in ratings of fatigue (but not of trail position difficulty), liking for food, time-dragging, overheating, thirst, chapping and concern with sleeping conditions, cooking and water-melting. Greater inter-subject variance obtained for ratings of concern with sexuality, uncleanliness, health, cold, and sore feet. The variation in inter-subject variances do not appear to be systematically related to the different questionnaires or to the level of ratings obtained. High inter-subject variability of ratings of certain phenomena such as sexuality and health implies that generalizations about changes in these phenomena under conditions of stress and hunger should be accompanied by <u>caveats</u>.

Social Effects of Hunger: Interaction

Talking

The previous section has shown underfeeding as producing two key effects: (1) more fatigue, with consequent lowered energy resources subjectively available; and (2) increased hunger. These effects imply that the men had more reason to be concerned with themselves and at the same time subjectively had less energy to give to interaction with teammates. A marked drop in sociability was noted by observers (Franklin *et al.*, 1948; Guetzkow and Bowman, 1946, p. 17) of the food-deprived men in the Minnesota study; these men were not otherwise under stress. On the other hand, laboratory groups deprived of sleep for 96 hours showed no decline in social activity (Murray *et al.*, 1959). Increased environmental (stress) pressure can in itself increase self-concern among full-fed men and lead to reduced allocation of available energy to interaction (Klein, 1956, p. 98; Torrance, 1959). Wartime prison situations, where both stress and underfeeding apply, typically are characterized by decreasing sociability (Cohen, 1953, p. 130; Leyton, 1946).

The term sociability can refer both to the volume and content of interaction. Items on two questionnaires in the present experiment concerned the amount or level of talking in groups (Appendix Tables 56 and 57). One question referred to the level of talkativeness in teams during the hour on the trail preceding the noon break, while the other referred to the volume of talking and conversation generally present in a group during successive test periods. Since men while trail-marching would not have much surplus energy available for talk, ratings on the first question were considerably and reliably lower than those on the second question (see Table 11). On both questions, however, ratings of level of talking in teams varied significantly with feeding level; underfed teams reported less talking.

TABLE 11

RESPONSE VALUES ON A SEVEN-POINT SCALE TO TWO QUESTIONS* RELATING TO TALKATIVENESS

Analysis of Variance

Source of Variation	d.f.	Mean Square	F	Significance Level
Questions (Q)	1	81.2250	111.53	.001
Subjects (S)	19	4.7171	6.48	.001
Periods (P)	3	2.9417	4.04	.05
QS	19	2.0013	2.75	.001
QP	3	0.7417	1.02	. .
SP	57	1.5252	2.09	.001
Residual	57	0.7283	. .	. .

Mean Values

Cycle	Phase	Question 1	Question 2	Avg.
I	1	3.30	4.95	4.13
	2	3.50	4.60	4.05
II	1	3.80	5.10	4.45
	2	3.80	5.45	4.63
Average		3.60	5.03	4.31

*1. Questionnaire A, Item 1 (Appendix Table 56)
2. Questionnaire B, Item 7-3 (Appendix Table 57)

In addition, the data showed two other trends. Data and analysis on the first trend, which was found to be statistically reliable, are shown in Table 11. There tended to be more talk reported in the later of the two cycles. In this cycle, subjects encountered easier weather (Table 4), could march faster (Table 5), and had fewer health difficulties (Table 10), so that strains of their response to environmental requirements were eased; with lessened discomfort, and less energy required for work, interaction rose. The second trend (significant for data in Appendix Table 56) was that there was less talk reported when subjects were carrying packs than when they were hauling packs on sleds. This finding is also congruent with explanation in terms of energy, in that the subjects had to work harder when carrying their packs (Table 3).

Humor and hostility

Signs of strain in a group may be a decline in humor, or predominance of sarcastic, ironic, and complaining notes in humor. These signs are not necessarily independent, in that sarcastic humor often is not funny. Increasing frequency of unfunny kinds of humor and disappearance of other kinds were noted by observers during the Minnesota test (Franklin _et al._, 1948). Fox (1959, p. 545) described patients in wards for serious cases as resorting to grim humor to ease tensions. Hostile-type humor increased in frequency among experimentally-deprived laboratory groups (Kelley, 1953). On the other hand, in another study (Lanzetta, Haefner, and Axelrod, 1954), laboratory groups threatened with a failure stress increased intra-team good humor.

Subjects in the present research were asked about good laughs during the hour preceding the noon break. Since there was not much communication during this period, humor ratings (Appendix Table 58) were low. They were a full scale point lower, however, among hungry groups than among full-fed groups. Also observed among these ratings were unreliable trends toward lower ratings over time within cycles, lower ratings when packs were carried on backs, and higher ratings in the balmier later cycle. These patterns conform with what is known about energy-demanding stresses undergone by these subjects.

Subjects were also asked about "bitching." This form of communication often is directed out of the groups and is complaining, querulous, or sarcastic in tone. It is the type of behavior sometimes classified as "hostility toward the outgroup" in group dynamics researches. Subjects' ratings (Appendix Table 59) of the veracity of the statement, "We do a lot of bitching," rose a full scale point under the hungry condition. No other trends were discernible.

Hostility toward outgroups was directly queried in two questions concerning subjects' annoyance and irritation with the scientific observers and with the other teams (Appendix Tables 60 and 61. Ratings were moderately high on both counts but did not vary with the hunger condition. Instead, they varied with time. Hostility toward other teams was reliably greater during the beginning and ending phases of the experiment, while irritation towards observers dropped a scale point between the successive cycles.

Summary

The averages of subjects' ratings of two items relating to talkativeness in teams indicate that there was considerable talk among full-fed teams but reliably less talk among hungry teams. Talk while trail marching was reportedly less than talkativeness in general (e.g., in tents at night). Intra-team agreement on ratings of talk was good. Less intra-team agreement obtained for ratings of "good laughs" on the trail. Ratings of this item were generally low and showed a reliable drop when men were in the underfed condition. Ratings of "bitching," on the other hand, were relatively high and increased reliably under the hunger condition. Ratings of hostility toward scientific observers and other teams also were relatively high but did not reliably vary with feeding condition.

Social Effects of Hunger: Group Atmosphere

Dimensions of group atmosphere were measured in the present experiment by a battery of questions derived in part from the work of Zimmer (1958), who under Navy contract prepared a test program to investigate psychosocial aspects of the under-ice life of IGY participants in the Antarctic. In this program were two attitude questionnaires (the Attitude Study and Group Behavior Description), which contained a total of 119 items oriented towards a man's feelings about group relations. Responses were to be given on a continuous unlabeled five-category rating scale.

Twenty questions from the Zimmer *armamentum* were first applied in Quartermaster Arctic research during 1959 (Levin *et al.*, 1962). On the basis of this research, certain of Zimmer's items were modified to suit conditions of the men marching across the Icecap in the present study; some items were dropped and others were replicated with modified wordings among the several questionnaires used in the 1960 Quartermaster tests.

Concurrent with Quartermaster research in the Arctic, the Neuropsychiatric Branch, Bureau of Medicine and Surgery, Department of the Navy, undertook application of Zimmer's schedules to men in small year-round camps in the Antarctic (Nardini, Herrmann, and Rasmussen, 1961). Data obtained were supplied for analysis to the U. S. Navy Medical Neuropsychiatric Research Unit at San Diego (Nelson and Gunderson, 1961).

The researchers at San Diego first categorized the Zimmer items on rational grounds by apparent similarity of underlying dimension. Ten clusters were formed, into which 80 of the original Zimmer items were fitted with good inter-judge agreement. The internal consistency reliability estimate of each given cluster was found to be higher than any of the nine correlations of that cluster with other clusters. Correlations between identical sets of clusters remained very stable over successive questionnaire administrations. With cluster consistency and stability established, Antarctic groups were compared in responses to each dimensional cluster of question items. The groups were found to differ significantly on almost all cluster dimensions.

The first five of the ten clusters were identified as A-E and referred to an individual's adjustment to his setting; the second five (F-J) referred to social attributes within a respondent's work group. The latter five were all significantly intercorrelated;[9] each reliably differentiated between groups examined. These five group dimension clusters were identified as:[10]

F. Compatability: perception of group members as mutually congenial and preferred as personal friends [affect].

G. Teamwork: perception of group members as cooperative and each carrying his share of the work [integration].

H. Group Efficiency: perception of group as well organized, having concise goals, and scheduled activities [task organization].

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[9] r varied from .21 to .78, with median values between .57 and .62.

[10] Words in brackets following each identification are terms by which the clusters will be identified throughout the remainder of this report.

I. Group Achievement: perception of group accomplishment and members' pride in same [goal satisfaction].

J. Equalitarian Atmosphere: perception of mutual respect, status leveling, and democratic procedures within group [power differentiation].

Nelson and Gunderson (1961) give a complete list of 46 of Zimmer's social items, each classified under one of the five headings. Items in the present study were classified under the same headings on the basis of similarity to items on their list. This classification was done before inspection of obtained data. Since both sets of items derived from the same source, the congruence between them was considerable and made classification straightforward. Only a few of the 46 item classifications of Nelson and Gunderson were changed. These are discussed under specific headings below.

Perusal of the analyses of variance of responses to each of the items appearing in Appendix Tables 60 through 99 will show that only a few among the items reliably revealed any effects of hunger. Responses to most of these items were characterized by high intra-group error variance. Therefore, use of the Nelson and Gunderson clusterings was an essential step in providing an independent basis for grouping data so that trends could be analyzed by the sign test.

Affect

Klein (1956, p. 146) supposes the case wherein ". . . a group of friends work hard to survive in an environment that has become uncongenial. By concentrating on the task, the friendship level of the group will tend to drop." The quarrels and arguments arising from the frustrations of an uncongenial environment are more disruptive in groups which are not composed of friends but rather are newly-created (French, 1953), as were those in the present study. Torrance

(1957b) maintains that under stress, ". . . group members become better acquainted with each other . . . and less harmonious." Guetzkow and Bowman (1946, p. 55) assert that despite extremely strong ties between subjects in the Minnesota experiment, they often lost their cohesiveness during the days of starvation. "'How much did you squabble?' people ask . . . . I will tell you. During the whole journey we never quarreled in the true sense of the word, although on occasion the atmosphere was certainly tense" (Lindsay, 1935, p. 206). As was true among the Minnesota subjects, hungry men often find it is too much trouble to fight, so bile is swallowed to be held for another, more prosperous day--or revealed in responses to questionnaires.

A dozen items on the three questionnaires administered to subjects during the present test concerned Nelson and Gunderson's cluster F, referring to intra-group affect. Data and analyses from these are shown in Appendix Tables 62 through 73. The first five of these are "positive"; that is, higher ratings in response to them imply higher affect of team members for one another. The remaining seven items are "negative" in that they refer to bad feeling and friction in teams; lower ratings to these items imply higher affect. A variant of one of the negative items ("strictness," Appendix Table 68) was originally classed by Nelson and Gunderson under cluster H, referring to task organization. Also a variant of one of the positive items ("first naming," Appendix Table 63) was placed by them under J, referring to power. The unsociable tone of the "strictness" item and the sociable tone of "first naming" suggested that for five-man groups on the Icecap these items could more realistically be placed in the affect classification.

Among the twelve items, only one ("irritation with teammates," Appendix Table 73) shows higher affect among hungry groups. Eleven items show differences in the expected direction, with lower affect among hungry groups. Under the two-tailed sign test, the null hypothesis can be rejected at the .01 level. These data clearly indicate lower intra-group affect and more friction among hungry subjects. They confirm, too, a basic axiom that a decline in interaction, such as was shown above to occur in hungry groups, is associated with a decline in positive affect (cf., e.g., Homans, 1950, p. 112; Bovard, 1951).

Power

Mills (1953) has shown a relationship between rate of exchange of supportive communication in three-person groups and the hierarchy of power positions. Although his data do not show that instability is associated with the absence of power development, Arctic groups under hunger stress showing reduced positive interaction might be expected to show both a less stable power structure and more equalitarianism. Power is the third of the four variables which Torrance (1959) cites as increasing in structural differentiation under moderate stress and declining in structure under more extreme stress. Bales (1955a) hypothesizes that as functional (e.g., adaptive) problems become more acute and demanding, strains are created toward the definition of more specific roles; as roles become more specific and differentiated, there is a tendency toward less equalitarian distribution of access to resources. As status differences between persons increase, there are strains toward more indifferent or antagonistic relations between them; "solidarity and status are in certain respects incompatable," Bales states, although goal-gaining inefficiencies of a loose power structure may lead to loss of solidarity.

There is then a question whether hungry groups, under greater pressure from the environment, will increase power differentiation (Bales) or diminish differentiation (Torrance). This was tested in the present study by observing the sign of differences between full-fed and hungry subjects' responses on items classed in Nelson and Gunderson's cluster J (differentiation). Six items used in the study (Appendix Tables 74 through 79) were classed by Nelson and Gunderson under the J heading; three items were positive in tone, three negative. With underfeeding, mean ratings of all six of these items shifted in the direction of greater status-leveling, although for none of these items was the shift statistically reliable. In terms of two-tailed binomial probability, the trend among these six items toward less differentiation under hunger stress is reliable at the .05 level. Since hunger in the Arctic may be regarded as high stress, Torrance's prognosis of reduced power structuring is supported by the evidence.

However, other evidence on power differentiation does not support the Torrance hypothesis. Two items on the B questionnaire (Appendix D) asked for near-sociometric rankings of teammates on the attributes "best answers to team problems (item 12) and "weight and influence in team" (item 15). Rankings on these two items (Appendix Tables 102 and 104) were very highly correlated; product-moment correlation coefficients of the matrix column sums (Hohn, 1953) for the two sets of data were .96 among full-fed subjects and .88 among underfed subjects. The two attributes both were derived from measures of power used by Lippitt _et al._ (1958) and resemble those used by Bales (1955b).

Hohn (1953) has developed a Hierarchy Index, h, defined as the ratio of observed variation in column sums of full rank matrices to the maximum possible variation. Index (h) values for the matrices of rankings obtained under the two criteria of power are shown in the appropriate appendix tables. The index values are generally high and no lower among hungry groups than among full-fed groups. This evidence suggests that the added stress of hunger had no effect on perceived power differentials.

Commonly, formal leaders suffer risk of displacement when environmental pressures on a group increase (Torrance, 1959; Klein, 1956, p. 104). On each of the two measures of power ("weight and influence" and "best answers"), leaders' sums of ranks were ordered about their median values. Chi-square values for the resulting two distributions were both significant at the .10 level.[11] Sums of ranks of formal leaders in hungry groups were reliably higher (i.e., represented less peer-perceived power) than in full-fed groups. That underfed groups ranked their formal leaders lower in power but maintained power hierarchies measured by Hohn's index indicates that substitutes were able to assume the relative dominance lost by leaders. At the same time, subjects' responses to the items in the "equalitarianism" cluster of Nelson and Gunderson, above, indicate that with partial displacement of the formal leader they perceived less status heirarchization.

Task organization

Three of the Zimmer items (all negatively toned) appearing on questionnaire B were classified by Nelson and Gunderson under cluster H (task organization). In their analysis these authors found, with groups having 22 to 40 members, that the correlation of this cluster with the preceding cluster (differentiation) was low. It would seem reasonable, however, that in small

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[11]Analysis of variance of leaders' rank sums on each of the two measures of power produced F-values significant at the .05 level. For application of parametric statistics to these and later data, see Boneau (1960).

groups with N = 5, correlation of perceived work organization with perceived formal differentiation would be quite high.

Response values on the three items classed under cluster H are shown in Appendix Tables 80 through 82. Differences between hungry and full-fed group average ratings are in the expected direction (i.e., less organization when hungry) on all three items. As error variances on these items were high, however, the difference between feeding treatments was statistically reliable on only one of the three items ("not everyone has a clear idea of what he's supposed to be doing").

Goal satisfaction

Task organization, communication, and differentiation are all associated with productivity. When these decline in groups, it is likely that satisfaction with group output will decline also. Three items in the present study were directly concerned with satisfaction of members with their teams as a whole. While member judgments of team performance (Table 12 and Appendix Table 83) were about as favorable in underfed teams as in full-fed, team satisfaction ratings (Appendix Table 84) were reliably (at the .10 level) lower among hungry groups.

TABLE 12

SUBJECTS' PERCEPTIONS OF CHANGES IN TEAM PERFORMANCE DURING PREVIOUS FEW DAYS (QUESTIONNAIRE B, ITEM 13)

Change	Packs on Sleds	Packs on Backs	Full-fed	Underfed
About the same	18	11	13	16
Worse	2	3	3	2
Improved	20	26	24	22

Integration

The Nelson-Gunderson cluster G included many items associated with the concept of integration (e.g., "everybody pulls together to get a job done"); integration has been defined (Stogdill, 1959, p. 277) as the capacity to maintain structure and function under stress. The cluster was found by Nelson and Gunderson to be highly correlated with their other clusters (r's ranged from .57 to .78), and especially with clusters F (affect) and I (goal satisfaction). The latter both are concommitant conditions of integration (Blau, 1960). With their decline, measures of integration should decline.

Lipscomb (1945) says of concentration camp prisoners: "The most conspicuous psychological abnormality was a degradation of moral standards characterized by increasing selfishness." In an experiment encouraging high self-orientation saliency, more conflict and lower goal satisfaction were produced (Fouriezos, Hult, and Guetzkow, 1950); in more conflicted (competitive) situations, there is less consideration, helping, affect, and satisfaction among group members (Deutsch, 1953; Marquis, Guetzkow and Heyns, 1951; Back, 1951). Freud (1949, pp. 48-49) associated group disintegration with the cessation of feelings of consideration among group members. In terms of these findings and viewpoints, items classed under Nelson and Gunderson's cluster G referring to selfishness, consideration, cooperation, and the like should reflect group integration, and measures of integration among hungry subjects should be lower than those among full-fed subjects.

Twelve items in the present study (Appendix Tables 85 through 96) concerned selfishness, cooperation, etc. and were identical to or congruent with items classed under the Nelson-Gunderson cluster G. Seven of these items were positively toned; five were negatively toned. Average ratings of positively toned items among experimental groups were high; those of negatively toned items were low. Ratings of none of the items showed a reliable main effect of the feeding treatment. In line with expectation, four of the five negative items indicated lower integration among hungry teams than among full-fed teams. However, five of the seven positive items showed _higher_ integration among hungry teams.

A possible explanation for these opposing patterns may lie in the conflict of two strains among subjects, between "truth" and "justice." With the onset of hunger stress, people appear to have added need for one another's company (Schacter, 1959, chap. 7). Social stimuli seem to dampen subjective response to stress (Bovard, 1951). Schacter quotes Torrance on the tendency toward lower cohesiveness in hungry groups and finds his results in conflict with this tendency. Torrance (1959), on the other hand, sees no conflict between clauses of the statement that, under severe stress, everyone needs social support, but capacity to give support is extremely limited.

Accordingly, hungry subjects may find themselves in an ambivalent situation, being unable to provide integrative behavior at the same time that they recognize the need for it in themselves and others. The "truth" may be that integrative behavior is low in hungry groups but "justice" demands recognition of the strains under which co-workers are struggling. Homans (1961, chap. 10) has recently illustrated how the idea of justice or worth can color sociometric choices. Affect toward co-workers may decline while respect for co-workers increases (Blau, 1960).

Thus it may be that at the same time that hungry subjects saw an increase in anti-integrative behaviors (Appendix Tables 92 through 96), their ratings of integrative behaviors were colored by cognizance of co-workers' efforts toward consideration, forebearance, helping, and the like[12] (Appendix Tables 85 through 91). This idea of forebearance toward co-workers may also explain why ratings of many items making direct reference to teammates are more favorable under the hunger condition; these include ratings of irritation with teammates (Appendix Table 73), respect for teammates (Appendix Table 79), preference for teammates (Appendix Table 97), and estimation of co-member performance (Appendix Table 98). Ratings of preference for own team also rose in the hunger condition (Appendix Table 99). All these items reflect a concept of loyalty to co-workers. The pattern of ratings on these items vis-à-vis feeding condition is in contrast with that obtaining from ratings of groups as a whole in terms of output, affect, organization, and differentiation. Rejection of the group accompanied by increased acceptance of members would seem to argue for the development of interpersonal ties in subgroups (cliques). This pattern is to be contrasted with that found by Bovard (1951), wherein hostility to restraints on groups led to downgrading of co-members but not of groups as a whole.

Summary

Ratings of twelve items focusing on positive and negative effect relations in the test teams quite consistently showed a trend toward less friendly behavior and more conflict within underfed teams. There was a considerable degree of variation between the various positively toned items in

[12]During interviews with hungry groups, the point was made that ". . . it's awfully hard to think of the other fellow when you're hungry; the only thing to do is to keep your mouth shut and try your best."

terms of favorableness of ratings; however, with few exceptions, ratings of positively toned items usually were higher than ratings of negatively toned items.

Ratings of six items focusing on authority showed a consistent trend toward less perception of differential power among members of hungry teams. The ratings of items positively relating to equalitarianism tended to be high, while ratings of negatively relating items were low; these evidences suggest low perceived authority-differentiation within the teams generally. Coupled with the trend toward lower perceived differentiation in authority among hungry teams was evidence, from peer rankings on items relating to power, that formal leaders were downgraded in the hunger condition. However, those rankings did not generally show less power differentiation in hungry teams than in full-fed teams.

Ratings of three items negatively relating to task organization were fairly high and tended to be higher (indicating more disorganization) among hungry teams. Ratings of items positively relating to member appraisal of and satisfaction with team performance were also quite high, although tending to be lower among hungry teams.

Data on integration and cooperation in teams did not show a clear trend with feeding condition. Ratings of positively toned items relating to integration tended to be high; those of negatively toned items tended to be low. Responses to negatively toned items showed less integration in hungry teams, while responses to positively toned items generally showed more integration in hungry teams. An explanation is sought by reference to the concept of "justice" or "esteem."

Social Effects of Hunger: Group Structure

Lipscomb (1945) reported that, in a deprivation condition, "In the first stage, consideration for others was limited to personal friends, then the circle contracted to child or parent, and finally only the instinct to survive remained." Jacobsen (1949) reports a parallel indrawing to intense diadic relationships. These experiences appear to represent a contraction of the Lewinian field (Lewin, 1951).

Cliques

Such a tendency would be favorable to the development of cliques at the cost of more extended linkages in groups. The presence of cliques appears to be associated with lowered effectiveness and integration in groups (Jenkins, 1947). Torrance, LaForge, and Mason (1956) observed a breakdown into cliques among a group subjected to an unexpected weather stress; on the other hand, Loomis and Loomis (1955) saw a discussion group supposedly not under stress similarly fractionate into cliques and make no functional progress thereafter.

Matrices of responses (Appendix Tables 100 through 104) to five items requesting sociometric rankings of team co-members on different attributes were analyzed to ascertain if hungry teams had more cliques than well-fed teams.[13] Since a prerequisite to cliques is mutuality, a count of reciprocal choices was made in each matrix. For these purposes, ranks one and two were counted as choice. When the number of choices is two, the maximum

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[13]A sixth sociometric item (Questionnaire C, item 7) was dropped from the study because it appeared to have little meaning in the intimacy of the experimental conditions.

number of mutual choices possible in five-man groups is five; this occurs in the circular structure A - B - C - D - E - A. Such a structure occurred only once among the 80 matrices (5 questions x 4 teams x 2 cycles x 2 phases) examined. The median number of reciprocals in a given rank matrix was about three, and this was almost invariant over different questions. Further, none of the experimental conditions show any systematic effect on the frequency of mutuals. According to this measure of group cohesion (Proctor and Loomis, 1951), hungry groups were as cohesive as full-fed groups.

Luce (1950) devised a matrix manipulation technique whereby indirect choices of the type "A chooses B who chooses C; so A chooses C" are accounted for in cliques of size three, four, etc. The number of indirect cliques of size three open to individuals in teams was computed for each matrix according to the method proposed by Luce. Resulting values were related to the patterns of direct mutual two-person choices. Where the pattern of direct mutual choices in the matrices "excluded" an individual (as in a matrix containing a four-person chain or four-person circle) or pair of individuals (as in a matrix containing a three-person clique), the number of indirect-linkage clique formations was low. The extent that indirect interlocking choice systems supersede direct mutual choice patterns is one operational measure of integration (North, Koch, and Zinnes, 1960). Thus a count of the number of matrices in the experimental conditions characterized by direct-choice triad cliques or four-person chains and circles formed an inverse measure of integration. This index of integration is in accord with one of Newcomb's (1954, p. 634) criteria of low cohesive groups: namely, shared disliking for one or two individuals.

On all five ranking dimensions, there were more "exclusions" (by means of cliques, four-chains, and four-circles) among choice matrices formed by hungry groups than among choice matrices formed by full-fed groups. For example, first and second choices on the "work with most closely" (Appendix Table 101) and the "helpful and sympathetic" (Appendix Table 103) attributes each contained only one exclusion among the eight matrices formed by full-fed groups and five exclusions among the eight matrices formed by hungry groups. The lower integration among hungry groups suggested by data discussed in the previous section thus seems confirmed.

Leader status and differentiation

The discussion of power differentiation in the previous section included mention of the deterioration of authority status of formal leaders in the hunger condition. Where cliques are found in groups, observers have noted that formal leaders are excluded (Jenkins, 1947; Loomis and Loomis, 1955). Since hungry groups were observed to form clique patterns on dimensions other than authority, it follows that the formal leaders would be likely to suffer decline in status on dimensions other than authority. This turns out to be so. Analysis of variance of leader sums of ranks on the attribute "work with most closely" (Appendix Table 101) shows a significant decline in status among leaders of hungry groups as compared with full-fed groups. Also, there is a trend toward higher sums of ranks (lower status) among leaders of hungry groups on the dimension "helpful and sympathetic" (Appendix Table 103). A similar significant decline in status of leaders of hungry groups obtains for rankings of "good leaders next year" (Appendix Table 100). On these three attributes, of course, leaders were less generally salient than they were on the two sociometric indexes of authority.

Hohn's index values discussed earlier in connection with leader power were also computed for sociometric rankings on the attributes "good leader next year" and "work most closely with." The increased dispersion of sums of rankings among hungry groups on these dimensions paralleled the increased dispersions noted among the power rankings. Generally it appears that informal leaders were able to gain the status lost by formal leaders in the hungry groups. However, the finding that concensus in rankings (i.e., dispersion of sums of rankings) does not diminish with the diminished interaction that accompanies underfeeding is contrary to Klein's (1956, p. 93) finding that groups with less interactions had less concensus. Torrance's (1957) observation of significantly less stratification after the stress of survival training also does not seem in accord with present findings which show that leader displacement is not accompanied by lower hierarchization, as measured by the Hohn index.

Stability

An observational check on the structural stability of the test groups was provided through records of noon seating orders. Daily, about noontime, each team halted on the trail, placed its two sleds end-to-end (broadside to the direction of the wind to serve as a windbreak), and dug a trench long enough to accommodate five men. The order in which team members were seated in the trench was recorded on nine of the ten days in each cycle. The end positions were presumably less desirable because body heat of a co-member was available only on one side and because the other side was exposed to winds coming around the ends of the windbreak. Also the wind and the fur-lined parka hoods restricted communication to immediate neighbors; men in end positions had only one neighbor with whom to talk.

A count was made of changes in seating order from day to day in terms of occupants of the end positions. The data are shown in Table 13. The rows

TABLE 13

FREQUENCY OF DAY-TO-DAY CHANGES IN OCCUPANCY OF EXTREME POSITIONS IN NOONTIME SEATING ORDER

	No Change	One Change	Two Changes
Full-Fed Teams			
Team A	3	4	1
Team B	2	2	4
Team C[1]	2	6	. .
Team D[1]	5	1	2
Sums	12	13	7
Underfed Teams			
Team A[1]	1	5	2
Team B[1]	1	6	1
Team C	1	7	. .
Team D	1	4	3
Sums	4	22	6
Expectancy	3.2	19.2	9.6
Comparable Changes in Noon Seating Order under Varying Conditions of Time and Task[a]			
First phases[b]	7	12	9
Second phases[b]	6	19	2
First cycle	7	17	8
Second cycle	9	18	5
Packs on sleds[b]	6	16	6
Packs on backs[b]	7	16	5

[a]Based on sums for phases, cycles, and task assignments.

[b]These add up to 28 rather than 32 because the first day of the second phase in a cycle was not compared with the last day of the first phase in the cycle.

in the table identify teams in each of the two feeding conditions. The columns indicate the degree of change in seating order: in the zero-change condition, the two men in outside positions retain these positions on the succeeding day; in the one-change condition, one of the two men on the outside is inside on the next day; and in the two-change condition both men on the outside on one day are in the inside on the next. The entries in the table give the frequencies with which each type of change occurred. Since there were nine days' observations in a cycle, the frequencies of changes add up to eight for each team, or 32 for all teams in a feeding condition.

The expected values for the frequency of each degree of change are shown in Table 13. Five men can be permuted 120 ways; twelve of these require no change in either of the occupants of the two outside positions, 72 require one change, and 32 require a change in occupancy of both positions. If changes between the 32 pairs of successive noontime orderings in each feeding condition occurred solely by chance rather than on the basis of some hierarchy or ordering of social links, the probabilities for zero, one, or two diurnal changes in occupancy of the less-desirable outside positions would be .10, .60, and .30, respectively.

Statistical comparisons between the set of expected frequencies and each of the observed sets of frequencies in the two feeding conditions were made, using the Kolmogorov-Smirnov two-tailed test (Siegal, 1956, pp. 47-52) instead of the χ^2 test because the expected frequency of zero changes was low. The set of observed frequencies of degrees of change among hungry groups did not reliably differ from chance, whereas the set of change frequencies among full-fed groups did differ reliably from chance expectancy. Chi-square applied to the two observed distributions indicated that they differed reliably from one another. The seating structure of the hungry groups over successive days was about as unstable as would be determined by chance factors, whereas the structure of full-fed groups was more stable. If one assumes that full-fed groups in the present study were under stress and were more effective, these findings are in accordance with Torrance's (1958) statement that ". . . the sociometric structure of small groups tends to become unstable under stress; effective groups show greater stability in sociometric structure than ineffective groups."

Contrary evidence obtains from sociometric rankings, however. In both phases within cycles of this experiment, subjects ranked each of their co-workers in four sociometric items (Appendix Tables 100, 101, 102, and 104). The stability of subjects' rankings of peers over successive phases within cycles was estimated for the two feeding conditions by a procedure analogous to Cronbach's D^2 (Cronbach and Glesser, 1952) in which differences between corresponding assigned ranks are squared and summed. Computed sums for teams, and individuals within teams, in both feeding conditions are shown in Table 14. Higher values imply less stability of ranks.

The obtained sums of squared differences between individuals' rankings of peers on successive phases were ordered about their median for each of the four questions. In no case did the instability values among hungry teams exceed those obtaining among full-fed teams. Indeed, there was a trend toward higher values (less stability) among the full-fed teams on three of the four sets of sociometric rankings; on one of these questions (Questionnaire B, item 12), the distribution of values about their median produced a X^2 value (corrected) of 3.84, significant at the .05 level.

Thus at the same time that hungry teams were displaying less stability in the patterning of their noon seating order, they were evidencing at least as much stability as full-fed teams in the patterning of reported work and

TABLE 14

SUMS OF SQUARED DIFFERENCES BETWEEN CORRESPONDING SETS OF PEER RANKINGS BY INDIVIDUALS IN SUCCESSIVE PHASES

Questionnaire	Item	Full-Fed Teams	Underfed Teams
B	15	A: 14 + 6 + 2 + 0 + 6 = 28	A^1: 2 + 0 + 0 + 2 + 2 = 6
		B: 6 + 2 + 2 + 0 + 2 = 12	B^1: 6 + 12 + 12 + 2 + 4 = 36
		C^1: 0 + 2 + 0 + 6 + 6 = 14	C: 2 + 6 + 6 + 0 + 0 = 14
		D^1: 20 + 2 + 0 + 8 + 0 = 30	D: 0 + 2 + 6 + 14 + 2 = 24
		Summary: > med:10;< med:10	Summary: > med:10;< med:10
B	12	A: 2 + 2 + 6 + 4 + 2 = 16	A^1: 0 + 0 + 0 + 2 + 6 = 8
		B: 12 + 14 + 0 + 2 + 8 = 36	B^1: 2 + 0 + 2 + 0 + 2 = 6
		C^1: 6 + 6 + 0 + 10 + 8 = 30	C: 6 + 2 + 2 + 0 + 2 = 12
		D^1: 18 + 2 + 6 + 0 + 2 = 28	D: 8 + 2 + 2 + 2 + 18 = 32
		Summary: > med:13;< med:7	Summary: > med:7;< med:13
B	5	A: 6 + 2 + 6 + 12 + 8 = 34	A^1: 10 + 2 + 2 + 2 + 0 = 16
		B: 10 + 0 + 2 + 2 + 4 = 18	B^1: 2 + 0 + 8 + 2 + 2 = 14
		C^1: 2 + 0 + 0 + 0 + 2 = 4	C: 8 + 0 + 2 + 0 + 2 = 12
		D^1: 8 + 6 + 12 + 2 + 4 = 32	D: 6 + 0 + 6 + 0 + 2 = 14
		Summary: > med:12;< med:8	Summary: > med:8;< med:12
C	5	A: 0 + 14 + 8 + 6 + 0 = 28	A^1: 0 + 0 + 2 + 6 + 2 = 10
		B: 8 + 12 + 0 + 2 + 2 = 24	B^1: 6 + 0 + 18 + 6 + 0 = 30
		C^1: 0 + 2 + 8 + 4 + 2 = 16	C: 0 + 2 + 0 + 0 + 2 = 4
		D^1: 0 + 2 + 6 + 0 + 2 = 10	D: 2 + 2 + 6 + 0 + 2 = 12
		Summary: > med:11;< med:9	Summary: > med:9;< med:11

affect relationships. The conflict in evidence becomes more apparent than real, however, when the data on seating order are analyzed in terms of proximate and distant pairs within daily permutations of seating order. In any given permutation of seating order in a five-man team, the *a priori* chance expectancy that a given pair in a team would be seated adjacently is .40. The expected frequencies with which given pairs of men in four teams would be adjacent on the basis of chance during nine days' permutations of seating order are provided by expansion of the binomial $4\ (10\ (.4 + .6)^9$. Typically, pairs would be found adjacent an average of 3.6 times in any set of nine permutations. In the comparison of obtained

TABLE 15

FREQUENCIES WITH WHICH TEN POSSIBLE PAIRS IN FIVE-MAN TEAMS WERE ADJACENT IN NINE NOONTIME SEATING ORDERS

Teams	Order 0	1	2	3	4	5	6	7	8	9	Total Pairs
Full-fed	6	1	5	8	6	4	7	3	. .	. .	40
Underfed	1	7	8	7	3	4	5	2	3	. .	40
All	7	8	13	15	9	8	12	5	3	. .	80
Expectancy	0.8	4.8	12.9	20.1	20.1	13.4	5.9	1.7	0.3	0.0	80

with expected frequencies (Table 15), certain pairs of test subjects apparently seated themselves adjacently more than would be expected by chance. This being so, necessarily other pairs were adjacent less often than chance would dictate (Edwards, 1948). More important for present purposes, however, is the finding that the obtained distributions for hungry and full-fed subjects were very similar; the χ^2 value obtained from the distributions is trivially low.

The evidence on stability, shown in Table 15, would seem, therefore, to form a certain pattern. The clique-prone hungry groups included certain pairs which seated themselves adjacently consistently throughout the test period, while full-fed teams had more cases at the opposite (aversion) end of the distribution. However, the two distributions did not reliably differ, and both sets of groups also displayed generally comparable consistency among replicated sociometric rankings. On the other hand, hungry teams included reliably more shifting within the noontime seating permutations than did full-fed teams. In hungry groups, then, pair relationships were relatively stable as compared with the seating structures of the teams as a whole. This suggestion--that team structure was less stably maintained in hungry groups but at no cost to intra-team interpersonal ties--is in line with the generalization arising in the previous sections, namely, that hungry subjects cared less about their teams but maintained their affect and esteem for co-workers as individuals.

<u>Summary</u>

While the frequencies of reciprocal choices in five sociometric dimensions were equivalent to full-fed and hungry teams, the patterns of these choices were not; there were consistently more instances among hungry groups wherein group majorities exchanged choices among each other and did not give any choices to one or two individuals in their teams.

Evidence of intra-group differentiation on rankings of work partnership, sympathy, and leader potential confirmed evidence on authority differentiation discussed in the previous section. Formal leaders had lower status on these attributes in hungry groups, but consensual hierarchization on these attributes was at least as high in hungry groups as in full-fed groups.

Hungry groups showed reliably less stability over time than full-fed groups on an observational measure of intra-group order (seating positions). However, sociometric rankings among hungry teams on four questions tended to be more stable than those of full-fed teams, and the stability of hungry groups' adjacent-pair relationships within seating orders was equivalent to that of full-fed groups.

Other Effects of Hunger

Findings on the impact of hunger on men and groups also include indications of a shift in evaluative factors; some after-the-fact judgments of subjects, provided via questionnaires and in individual interviews during the post-experimental period, gave support to earlier findings.

Factors in sociometric judgments

The possibility that hunger might change the criteria by which peers in groups were evaluated on various attributes was investigated by means of factor analysis. Responses to six sociometric items were included in the analysis (Appendix Tables 100-105). These included the five ranking items discussed in the previous section, plus one additional item (Questionnaire B, item 16) requesting subjects to rate co-workers as preferred teammates on future teams. This last item was included because it aimed at providing an index to congeniality between individuals within teams.

In each feeding condition, column sums of ranks were correlated among the four items calling for a full ranking of team members. The mean of rank matrix column sums for these items was a constant $\frac{n(n-1)}{2}$ for rank matrices from all teams. A fifth item (Questionnaire B, item 14) required only two choices among a subject's four teammates; the two choices provided were identified as ranks 1 and 2 and to their sum was added 6, representing an arbitrary sum for unnamed ranks, to complete column sums. The sixth item called for ratings of preference for co-workers as future teammates. Since the means of rating matrices varied from team to team, column sums of each matrix were identified as deviations from their mean.

The two matrices of correlations (one for each feeding condition) among the six sociometric items were factor analyzed and rotated by the varimax method with the aid of Univac.[14] Orthogonal factor loadings on the six items under each of the two feeding conditions are shown in Table 16. The first factor emerging has heaviest loading in the two sociometric items providing data on power differentiation; it is termed "authority." The second factor appears predominantly in correlations with ratings of peers as future teammates; it is termed "congeniality." The third factor clearly refers to "sympathy."

In both feeding conditions, the authority factor accounted for about 36-38 percent of total covariance. Predictably, the item asking for peer rankings as potentially good leaders on another team was moderately loaded on this item in both feeding conditions. The two feeding conditions varied, however, in the loadings of the remaining two of the first three factors. These two factors accounted for almost all remaining covariance in the hungry condition; however, in the full-fed condition, other factors in addition to the first three were required to account for the whole of covariance. In particular, the first three factor loadings on the work partnership item ("work with most closely") were trivial in the full-fed condition but considerable in the hungry condition. Too, the loading of the second factor

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[14]The service provided by Professor Alex Orden, Director, Operations Analysis Laboratory, University of Chicago, and his staff is gratefully acknowledged.

TABLE 16

ROTATED FACTOR LOADINGS OF SOCIOMETRIC MEASURES

Questionnaire and Item No.	Full-Fed						Underfed					
	Factor						Factor					
	I	II	III	IV	V	h^2	I	II	III	IV	V	h^2
1. (B-16) Preference for persons as future team-mates	.021	.968	.206	.145	-.013	1.001	.197	.911	.335	.122	.009	.996
2. (B-15) Weight and influence of persons' ideas and opinions	.976	.024	.067	.155	.114	.995	.900	.244	.200	.119	.273	.998
3. (B-14) Persons most helpful and sympathetic	.137	.262	.904	.264	.161	1.000	.176	.310	.925	.115	-.001	.996
4. (B-12) Persons' contributions of good answers to team	.931	.039	.161	.129	.286	.993	.939	.157	.180	.135	-.204	.999
5. (B-5) Persons worked with most closely	.224	.226	.283	.882	.200	.999	.396	.486	.545	.533	.002	.974
6. (C-5) Persons who would make good leaders next year	.513	-.057	.257	.284	.766	1.000	.580	.595	.284	.417	.029	.946
λ^2	2.152	1.062	1.036	.990	.748	5.988	2.255	1.600	1.418	.518	.117	5.908

(congeniality) on the potential leadership item was zero order in the full-fed condition but considerable in the hungry condition. Other items also tended in the hungry condition to have slightly more loading on the first three factors.

The gist of this analysis appears to be that the multi-dimensional structure of relationships was simpler in the hungry teams. The three attributes--authority, congeniality, and sympathy--almost wholly shaped sociometric scores on the six attributes considered. Among full-fed teams, however, the evaluative structure was more complex, so that, e.g., a man otherwise unauthoritative, uncongenial, or unsympathetic could be judged favorably as a working partner or as a potential leader. It would appear that members of full-fed groups had more planes on which to compete, show excellence, and establish some form of status. Among hungry groups, a man lacking high authority, sympathy, or congeniality was less valued on other terms.

Hungry men are men in need. French (1956) has remarked that subjects with salient needs (e.g., for affection) will always choose others whom they expect will satisfy those needs, regardless of the category of behavior called for in the specified situation. In terms of hungry subjects in Greenland, three needs seemed predominant. "Every individual has three interpersonal needs: inclusion, control, and affection . . . . [These] . . . constitute a sufficient set of areas of interpersonal behavior for the prediction and explanation of interpersonal phenomena." (Schutz, 1958, p. 13.) With substitution of "sympathy" for inclusion, "authority" for control, and "congeniality" for affection, this would appear to state the case for hungry men in Greenland.

Post-experimental judgments

Hungry subjects rated their individual co-workers at least as favorably on various attributes as did full-fed subjects. (See Social Effects of Hunger: Group Atmosphere, preceding.) This would imply that the enhanced interdependencies and esteem brought on by stress would lead to lasting post-experimental friendship patterns, as Fox (1959) observed among hospital patients.

Peer choices among the entire assembly of subjects on the attributes "preferred on next team," "good performer," "helpful and affectionate," and "popular" were obtained after conclusion of the experiment (Table 17). Since each man served with a different set of team co-members when hungry and when full-fed, the number of post-experimental nominations he received from those with whom he served while hungry could be compared with the number he received from subjects with whom he served only when full-fed. No systematic differences

TABLE 17

FREQUENCIES OF POST-EXPERIMENTAL NOMINATIONS OF SUBJECTS BY UNDERFED AND FULL-FED CO-MEMBERS

Teams	Preferred as Teammate	Performance		Affectionate		Popular
		Good	Poor	More	Less	
Underfed	12	11	16	16	8	13
Full-fed	16	5	11	22	8	11

are to be observed in the frequencies with which subjects were nominated by hungry co-members or by full-fed co-members, except that being underfed apparently evoked both performance extremes. It would appear that undergoing hunger stress with a fellow did not markedly affect one's judgment of him either favorably or unfavorably. These post-experimental data confirm the finding that favorableness of intra-experimental ratings of individuals did not fall during the hunger experience.

During personal interviews conducted a week after test completion, men were asked to compare the two teams on which they served in terms of talk, good feeling, and the like. These retrospective judgments confirm other findings indicating diminished interaction, affect, and integration

TABLE 18

CHOICES BETWEEN UNDERFED AND FULL-FED TEAMS ON CERTAIN ATTRIBUTES*

Teams	More Talking	More Bossing	More Good Feeling	Better Organized	Lonelier	Stronger Leader
Underfed	6	13	4	5	11	11
Full-fed	12	4	15	14	2	8

*Frequencies add up to less than 20 because one man missed his interview and because some respondents could not make a choice between the two teams on some attributes.

among the hungry groups. However, the response pattern to items on "bossing" and "strong leadership" are not in accord with data obtained during the experiment showing less power differentiation and weaker leadership in hungry groups than in full-fed groups. The conflict between the evidence obtained during the test and post-experimental reports may be due to some peculiarity of wording of items. Alternatively one might suppose that there was in fact less display of authority among hungry teams but in retrospect the unpleasantness of such bossing as there was led to exaggeration of its importance.

Post-experimental comments by subjects

Generally the subjects felt rather negatively toward their hunger experience. During interviews after the experiment was over they presented a variety of reasons why underfeeding of military teams is not a promising logistical device. A few subjects' reports of characteristics of their full-fed and underfed groups are listed below.

Full-Fed Groups	Underfed Groups
There was more suggesting, but it worked better because the men got together. Everybody made suggestions. The men worked better, got to know each other's habits better; more talking.	More unfriendly feelings. Everyone was agitated, had irritable arguments.
Everything kept getting better; everybody had better feelings; even if some people slacked, others would pitch in.	Lots of chief; rest of us were Indians. It made for bad feelings.
It was perfect. Man, we had somepin' goin' there.	Work ability changed; got slower.
Better group, had more teamwork, more laughter. Everybody worked together; guys as a whole had a good share of humor.	Lonelier.
We joked more. I had more fun, an easier time; it was more friendly. Most of the time we would joke.	Group changed from good to bad, got more and more irritable, with "I don't give a damn" attitude. All they wanted was food for themselves, just to get their belly full. They were all out for the same thing: food.
We talked about food, discussed North and South. They used to make fun of me--good, clean fun.	We kept getting more hungry, more weak, nerves more on edge, jumpy, and tired. Hunger and fatigue combined to make us more irritable. Group had "f___-the-other-guy" attitude; "every man for himself."
Full rations are better. You perform better, feel better; group performs better.	We were depressed.
We had high spirits, felt like sitting up late at night. I didn't have to order any man to do a special job; he did it anyway because of more food. They got along better. Men were friendly types anyway.	Everybody was bored. I didn't have anything in common with anybody; neither did the squad leader. It was just dead, just sit, sit, sit. Nobody initiated any action. I tried to joke, but nobody cared.
	Every time I attempted to lead, I got an argument.
	Everybody was a bunch of deadheads; everybody wanted to go to bed. It was like everybody was going to die tomorrow.

Full-Fed Groups (continued)	Underfed Groups (continued)
On full rations you go to bed satisfied. Full rations help a lot.	On low rations, a man can survive but it slows you down, makes you irritable. You're not as thirsty as when you're on full rations.

The picture reflected in these comments largely conforms to evidence presented in previous sections. Interestingly, however, there was not any mention of the respect for co-members which sociometric ratings indicated was not weakened in hungry groups. The comments suggest, however, that in addition to fatigue, a pervasive tendency to irritability towards one's co-workers was one of the subjective burdens of hunger.

Summary

Factor analysis of six sociometric items showed that an "authority" factor accounted for an equivalent to proportion of variance in both feeding conditions. Hungry and full-fed teams differed, however, in the proportion of remaining variance accounted for by two other factors ("sympathy" and "congeniality"); in hungry groups this proportion included about all the remaining covariance, whereas in full-fed groups the first three factors left a good proportion of covariance unaccounted for.

In post-experimental sociometric choices and judgments of teams, subjects chose former co-members in their hungry groups about as often as they chose former co-members in their full-fed groups; however, they differentiated between the full- and underfed teams in terms of good feeling, organization, "bossing," and other attributes. Comments made by subjects after the experiment generally supported differential judgments between teams.

Social Effects of the Other Variables

In a way, the test teams started out with an advantage. While newly-formed groups are likely to be more disturbed by external stresses (French, 1953), at the same time they do not have internalized goals to meet, nor established structures of behavior and relationship which may be inappropriate to the needs of an unusual situation. Therefore it is possible that the phenomena typical of established groups under task stress would not apply wholly to newly-formed groups lacking developed structures.

Phases in the development of interaction in newly-formed task-laden groups have been examined by Bales (1955b). The first phase centers on orientation, as members feel each other out and come to know each other. The second phase concerns evaluation and trial of alternative ways of doing things. The third phase has to do with controlling members along decided paths. During these task activities there is a build-up of tension and frictions as group members are subjected to necessary restraints and become involved in progress toward a goal. Thus periods of structure-building and goal-achieving are not necessarily conducive to happiness with co-workers. Usually when they terminate there is a breakdown of interaction into affect-laden interpersonal exchange.

Time

Test teams starting out the first cycle reported moderate talking in teams (Appendix Table 56). Under conditions of hard work and task organization, the tendency for friction with co-workers increases (Marquis, Guetzkow and Heyns, 1951); most of the items (Appendix Tables 62-73) in the Nelson-Gunderson cluster F (affect) did show such a tendency between phases within cycles. Continued hard work puts a strain on integration; items (Appendix

Tables 85-96) which according to Nelson and Gunderson reflect this attribute showed less cooperation with passage of time within cycles. On the other hand, satisfaction with and esteem for teams and co-members remained high (Appendix Tables 83 and 84) in line with Homans' (1950, p. 90) dictum that work interaction leads to respect. Ratings of task organization (Appendix Tables 80-82) and equalitarianism (Appendix Tables 74-79) suggest that the satisfaction was with the work done rather than with development of an effective structure of task interaction. At the same time, team leaders generally maintained sociometric status (Appendix Tables 100-105) over time within cycles on all dimensions. Mean choices given to co-workers as good performers and as preferred teammates (Appendix Tables 98 and 105) showed consistent increases in differentiation (i.e., range) within teams. The stability of sociometric agreement on the hierarchies of authority and competence (Appendix Tables 102 and 104) as measured by Hohn's h was also maintained over time within the first cycle. Finally, stability in occupancy of the outer positions in team seating orders was greater in the second phases within cycles (Table 13).

The picture that emerges is one of teams pressed hard by the environment[15] and by the need for task-structure building; they were therefore unable to give much energy to the promotion of affection and integration. A hierarchy of valuation of membership in terms of respect and competence became clearer over time, and satisfaction with team performance was maintained. However, there was not much fun in the group; humor and the joking relationships, which usually develop in teams to grease the slots of interaction, declined slightly over time within cycles (Appendix Table 58).

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[15]In the second phases the teams marched upwind and so had a more difficult time.

Teams starting the second cycle were more like established groups. Their members were acclimated and skilled. With an easier environment to work in (Table 3), they had more energy to talk and joke (Appendix Tables 56-58). Their hostility toward outside observers diminished (Appendix Table 60) and they had more control over irritability (Appendix Table 71), more good feeling (Appendix Table 65), more consideration (Appendix Tables 87 and 91), and more overt argument (Appendix Tables 62 and 72). However, they were faced with conflicting sets of task patterns and values as a result of the intercycle mixup in team membership. Both sociometric concensus and interphase stability were consistently lower among second cycle teams on all sociometric rankings other than that referring to authority (Appendix Table 104). Stability of occupancy of outer positions in noon seating orders was equivalent in the two cycles (Table 13).

The findings about developments in interaction and structure in the newly-formed test teams over time present a somewhat consistent pattern. Within cycles, the groups over time reported declining humor, affect, consideration, and satisfaction with organization, while maintaining interaction rates and relatively high and stable informal structures. Second cycle groups, on the other hand, reported more talk and humor, and less latent hostility, while maintaining less stable and less hierarchial sociometric structures; leaders, however, were ranked no lower than in the first cycle. Esteem for co-workers as desirable teammates and as good performers tended to remain good both within and between cycles, and satisfaction with team output remained high. If one supposes that by "more talk" the subjects meant more non-task talk, then under work stress talk is more restricted to task problems. Humor, integration, and affect suffer; structure is established and stable; and hostility is directed at outgroups. Under less stress, as in the second cycle, talk, humor and argument increase, and the stability and stratification of dimensions of sociometric status are reduced.

Task

Subjects were exposed to two different tasks. One cost team members slightly more energy, and therefore, in Stogdill's terms (1959, p. 280) represented slightly more group input. Talk and humor declined when teams were under the more energy-demanding task (Appendix Tables 56-58). However, several measures (Appendix Tables 70 and 71) showed less intra-team friction in the harder task. Generally, too, measures of affect (Appendix Tables 62-73) and integration (Appendix Tables 86-96) were more favorable in the more difficult condition. Table 12 shows members' evaluations of change in team performance; subjects under the harder task tended to see more improvement in performance. This pattern of findings conforms to Stogdill's statement that "an increase or decrease in inputs permits an increase or decrease in productivity, morale, and integration simultaneously" (p. 277), where morale is defined as freedom of restraints against the group goal; integration is the capacity to maintain structure and function under stress; and productivity is measured by change in expectation based on outcomes of past performances.

Measures of sociometric stability could not be compared between task conditions because teams switched tasks between phases within cycles. However, the stability of team seating orders (Table 13) was invariant between tasks. Measures of hierarchy (Hohn's h for ranks, and range of sociometric ratings) and leader status were relatively unchanging under the two task conditions; this was so for clique incidence too, and for average rank and ratings of leaders. The decline in talk between task conditions was not associated with a deterioration in group atmosphere.

Summary

In established groups with established hierarchies, the stress patterns may superficially appear otherwise. Attending to work demands, members cannot give energy to status maintenance; hierarchization becomes unstable and declines (Stogdill, 1959, p. 281). Torrance (1957b) reported significantly less stratification after groups underwent survival training. These tendencies can be reconciled with findings for the newly-formed Greenland teams by supposing that during work stress, original hierarchies are maintained because there is not time or residual energy to fight about them, but they are weakened so that after completion of a hard job they cannot be re-asserted. Something of the sort is suggested in the Greenland second-cycle data, in which sociometric hierarchization was lower, even while environmental demand was eased. On the other hand, small changes in the amount of work required, while other aspects of the environment remain constant, need not produce changes in affect, integration, and structure, even if supportive interaction temporarily declines. Apparently teams were able to adapt to the moderate added strain of carrying packs on their backs without notable disturbance in intra-team relations. In this case the axiom that affect varies with amount of communication was not demonstrated.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Unembellished fact can mislead when not hedged by qualifications on its context and not anchored by relation to a corpus of theory. The setting of this experiment, the social condition of its subjects, and the research methods (Appendix B) each necessarily shaped the data so as to make them not exactly comparable to previous findings. Nonetheless, comparison of the data with generalizations from previous findings is necessary to lend validity to the former and consistency to the latter.

Initial Condition of the Teams

Central features in the experimental context were the compulsory nature of subjects' assignment to the test and to test groups, the autonomy of the groups, and the isolation and sterility of the environment.

Compulsory groups

Test subjects were not keen about being guinea pigs in the Arctic. When they learned that the independent variable was ration intake and that no compensatory leave for the required strenuous duty could be promised, they were less enthusiastic. Assigned to groups, they discovered that they had not been paired with their buddies. The resulting groups were generally characterized by both disaffection of members from prescribed goals and relatively low initial inter-member reciprocity.

These two attributes typify compulsory groups, as when individuals are forced into non-voluntary relationships ". . . which include most prominently the possibility of being forced to endure low outcomes" (Thibaut and Kelley, 1959, p. 67). Workers in organizations commonly associate with co-workers not by choice but because they have to make a living (Katz, 1951, p. 76); however, such working groups are not ordinarily bounded by high barriers to escape and by the absence of alternative associations, as was true for the Icecap test groups. Sick call, although used frequently in earlier stages of the experiment, could provide but temporary remission. Thus, the constraints on subjects in this study differ from the constraints of moral suasion and identification with abstract scientific aims which characterize subjects in other laboratory studies of stress (Keys _et al._, 1950, p. 914; Lebo, 1953, p. 6).

Group members typically resent and resist changes imposed from outside their groups (Stogdill, 1959, p. 287). The periodic imposition on the test teams of changes in activity (and method of activity) emphasized their complete, almost artificial, lack of autonomy. The daily distribution of food to individuals by test administrators removed from the teams their allocative control over a key resource. The arbitrary quality of team existence was reinforced when memberships were switched between cycles, and informally-established, cooperative practices were thereby threatened (Blau, 1957).

Thibaut and Kelley (1959, p. 182) point out that, since compulsion leads to resistance,

> By sharing their hostility toward the oppressors, the members may experience both an increase in affiliative outcomes (mutual respect and affection) and a "rising moral pride" from having repudiated the impulse to give in to their captors. These gratifications may be sufficient to sustain the members even when the objective probabilities of their being able to crash the social barriers (escaping, revolting) are extremely low.

North, Koch and Zinnes (1960) term these "potentially revolutionary situations."

The test team in the Greenland study which received highest evaluations from its members was one in which hostility to and disobedience of test requirements were most overt; this team was able to accomplish a number of sensational food-stealing raids. Also pertinent in this connection is the fact that among the negative social aspects of the Greenland test, those rated most highly by subjects were hostility towards other teams and toward the scientific observers (Appendix Tables 60 and 61). Hostility towards "the Army" was undoubtedly greater.

Expectations and information

That informal cooperative practices evolved in groups so deprived of control over (a) membership; (b) development and allocation of resources; and (3) goal selection, internalization, and activity, may be due in part to the low expectations of team members. The extended briefing held just before the start of the test helped to disillusion subjects of hope that they would have anything but a hard time. Bass (1960, p. 42), Thibaut and Kelley (1959, passim), and Stogdill (1959, p. 281) each point out that since groups are evaluated by members in terms of how much they reward members' expectations, low expectations may permit favorable evaluation of impoverished groups.

The briefing also helped to eliminate surprise from the environment. Teams began with good information about the external set of rules they had to follow and the nature of demands from the environment. They knew that with organization they could cope with these rules and demands. Thus the stress imposed was a task stress with a relatively low component of anxiety.

Shared miseries

The stresses imposed on teams were common to all members. Formal leaders had to man-haul with the rest. All men in a team had equal access to the key asset of food; the confining conditions of living on the Icecap did not allow surpluses in other resources which might become objects for competition for differential distribution. The sole differential resources of leaders were official support and better access to information from the wanigan train. These conditions favored subjects' awareness of common fate and the advantage of cooperation rather than competition. "Where all members have similar positions and similar access to resources, differences in status cannot become permanent" (Klein, 1956, p. 18).

Moreover, the impact of experimental stresses affected members directly. External demand was not on teams as corporate bodies to which members would rally round in loyalty (if they had had any loyalty to the test teams). Thus the nature of strains was dissimilar to cooperative tasks imposed on *ad hoc* groups in laboratories.

Total groups

Another factor favoring growth of integration and structure in test teams was the dependency of members on their teams for survival. Housing, warmth, and transport were available to members only through conjoint effort. Sloppy coordination of this effort meant cold wind pouring under the tent flaps at 3 a.m., a stove that would not cook, or sore muscles from erratic application of tension to pairs of man-hauling ropes. This physical dependency was no doubt supplemented by psychosocial dependency under stress, such as Schacter (1959) has examined: "Hunger likes company." However, the close inter-dependency within teams (such that, e.g., if a man rolled over in his sleeping bag others probably had to move too) throughout the daily 24 hours probably was a large factor in the growth of interpersonal consideration and respect. A member socially rejected by his teammates could not be kicked out of the team but his lot could be made unhappy for him. There would be no place to which he might turn for even temporary succor; other teams could not accept him, the control wanigan would not, and the environment offered nothing. Consequently the test teams almost totally dominated the lives of their members in all phases of living that were not under rigid experimental control. This favored cooperation among members.

Sterile environment

The blank and chill wasteland outside the circle of team activities had a disintegrative function. It enforced total intimacy.

> Some aspects of the intimacy of sledging life have not any parallel elsewhere; no, not even in marriage. (I am thinking at this moment of the sanitary arrangements when we lay up in a blizzard, perhaps for days together, in a tent which was so small that we covered the whole floor space when we lay down). It is common knowledge that there is usually discord when two or three men are forced to live together in the unrelieved possession of each other's company. In our case you must square and cube the strain of unbroken intimacy . . . (Lindsay, 1935, p. 206).[16]

Rose Coser (1961) suggests that extended face-to-face observability can make role-conflicts more severe. Even without role-conflict, men retain a residual need for privacy, for the performance of personal acts which are conventionally tabooed. In the norms developed within the Icecap teams, necessarily there came to be considerable tolerance of much normally-tabooed private behavior.

Besides forcing the men into unrelieved intimacy, the environment probably had direct effect on their verve. There was a dearth of things to talk about and little external stimulation to which men could share reactions. The arrival of a mail helicopter would perk them up briefly, but as their eyes followed its departure out across the vacancy until it became merely an orange

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[16] Apropos Lindsay's parenthetic remark, observers noted that subjects using the common team latrine always carefully covered their output with snow in token effort to reduce total intimacy.

spot on the horizon and then disappeared, talk would disappear too. Interviewing by the observers came to be a valued source of social intercourse, and ratings of hostility to observers declined over time. A trip to the wanigan on sick call or a like duty was the only occasion when a man could escape his fellows and so be in a position to bring back news to them. Lindsay (1935, p. 165) noted that interpersonal exchange becomes a heavy effort; high spirits dissipate; humor becomes sarcastic: "One's reflections were neither purposeful nor constructive, at any rate after the first few days--merely dull, heavy thoughts, as dull and heavy as the day's work." Through its effects on communication, the monotony of the test setting probably had a hampering effect on the development of integration in the test teams.

Summary

Factors probably promotive to integration (e.g., compulsion, totality) were offset by factors depressing to interaction (excess intimacy, monotony). Subject ratings of social attributes of their groups suggest that the promotive factors dominated. In contrast to the high ratings of personal complaints, ratings of social complaints never averaged higher than the middle of the rating scale and clustered at the bottom end of the scale. On the other hand, ratings of favorable attributes of teams clustered at the top of the scale. The very highest ratings were given to such attributes as team performances (Appendix Table 83), individual co-member performance (Appendix Table 98), satisfaction with teams (Appendix Table 84), preference for teammates (Appendix Table 97), and coordination-cooperation in teams (Appendix Tables 85-89). Thus, in their responses to questionnaires, the subjects generally maintained a loyal front, probably because there were no dependable objects for loyalty alternative to one's own team. Eren and Auld (1954), in a study of confined submariners, report finding increasing concern about maintenance of loyalty and consideration toward teammates. Conditions of high interdependence against external threat, no matter how compulsory and arbitrary, are likely to lead to increased normative taboo on criticism of teams or differentiation among co-members, especially to outsiders (Gerard, 1953).

Comparison of Findings

Most of the reported non-social and social effects of underfeeding in the experimental context were expected. More interesting are expected effects which did not show up in the data.

Non-social effects

The finding that test subjects' sense of fatigue increased markedly under a 1500-calorie daily deficit over a ten-day period confirms the commonplace (e.g., Keys et al., 1950, p. 706). At the same time, laboratory tests (Buskirk, 1957) show that men's work capacity under such deficit does not notably deteriorate. The sense of fatigue accompanying hunger accordingly in one sense is not based on "reality." However, even if their capacity for work remains intact, hungry men will resist work; in this sense their fatigue is real enough. It is as though their threshold for tiredness has dropped so that any given increment in work seems more tiring.

The respiratory data in Table 3 indicate that the difference in energy demands of the two pack-carrying methods was slight, amounting to only about one cc_{O_2}/min/kg. Over a six-hour man-hauling day a 170-pound subject would expend only about 150 calories additional energy using the more difficult pack-carrying method. This is only a four percent differential in terms of the 3900-calorie daily expenditure estimated for the Greenland subjects. The small differential was not reflected in fatigue ratings of full-fed men but clearly appeared in ratings of the underfed men (Table 9). A change in fatigue threshold again is suggested.

Underfed men were also more concerned about the minor muscle and foot disorders accompanying acclimation to their task. In terms of the heightened sensitivity apparent in the hungry men, it is therefore noteworthy that they did not respond differentially to the considerable cold stress, especially in the first cycle. To observers, the underfed groups always seemed more bundled and huddled up, seeking more escape from the wind and displaying less facing up to the wind. They cut short their trail breaks, complaining that they were too chilled to sit down and relax. Yet they reported no more awareness of time-dragging, or concern about chapping of face and hands, than were reported by full-fed men.[17] The surprise in this negative finding is partly derived from the fact that so many other expected effects of hunger were confirmed.

Greater concern about uncleanliness among hungry subjects also was in conformity with previous evidence. Observers' anticipation of a reduction in grooming among hungry subjects was confirmed; thus higher ratings of concern with uncleanliness (Appendix Table 53) were partly based on reality. Another interesting phenomenon observed occasionally only among hungry subjects were rapid fluctuations in mood; ". . . unstability, erratic changes, jumps and jerkiness pervade the victims' affective and emotional processes . . ." (Guetzkow and Bowman, 1946). Underfed subjects were seen to break out into an extensive foul-mouthed rage and then instantaneously drop it. Two men

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[17]Early attempts to record differential evening temperatures inside tents were dropped because stove functioning and tent construction overrode any influences which personal temperature choice might have had.

displayed fits of giggling, sobbing, and tears which took time to overcome. The subjects themselves (see Other Effects of Hunger [Chapter IV]) reported that volatility of mood was a disturbing influence in social relations in hungry groups. Teams inevitably adjusted to these and other aberrations accompanying hunger by dropping norms of ordinary social behavior (Goffman, 1958).

The food behavior and responses of underfed men conform closely to the observations of Keys and his associates (1950). For example, eating lunch on the trail, hungry men ". . . ate silently and deliberately and gave total attention to the food and its consumption" (p. 832). The dominance that food attains in the minds of underfed men has been well attested (Lindeman, 1958, p. 131; Lindsay, 1935, p. 271; Freuchen, 1935, pp. 220-221; Atkinson and McClelland, 1958). That palatability and valuation of food as indicated in preference ratings was higher among hungry men (Appendix Table 28) is quite in line with expectation.

Social effects

Teams reported less talking under conditions of greater stress, whether these conditions were the more difficult task, trekking in the more unpleasant first cycle, or being hungry. Level of ratings of peers,however, generally were invariant, and the stability and stratification (differentiation and consensus) of sociometric ratings tended to vary inversely with talk and humor. These more usually vary directly with interaction in laboratory discussion groups (Mills, 1953; Klein, 1956, p. 93; Hunt and Solomon, 1942). The more bits of information a person receives about another, the more the redundancy; an increasing proportion of redundant information ought to be conducive to stability of estimates about peers. Similarly, more interaction means a person's attributes are more widely displayed, so his peers come to have common information about him; this is conducive to consensus (Klein, 1956, Appendix).

However, conceivably the relation between interaction and stability-cum-consensus is non-linear. Minimum interaction provides little basis for change of peer estimates, and a paucity of clews favors inter-peer agreement on bases for judgment of a person. Also, task interaction tends to be codified; an increase in task interaction would not necessarily provide concommitant increase in information about an actor as an individual. Decreasing task stress (as in the second cycle) would, on the other hand, allow more energy for exploratative interaction and new contacts. New contacts would be conducive to change and instability in sociometric choices, to inter-member heterogeneity in groups. With expansion of channels of social exchange and of the content of exchange, social transparency of choice (Taguiri, Kogan, and Bruner, 1956), would be lower and mutuals would be less frequent. This may explain Scott's (1950, p. 103) finding that a count of the number of non-reciprocal nominations served as an inverse index of morale on ships; "low morale" groups may simply have been those which had not yet achieved "sociometric maturity" on account of insufficient time or chaotic communication conditions. The point made by Klein (1956, p. 66), that a greater number of communication links reduces the likelihood of mutual choices, seems pertinent; in her leaderless discussion groups, in which each member could communicate with all others, there were no mutual choices more than 50 percent of the time.

Declines in informal interaction (talk) in stressful conditions in the present experiment were not usually accompanied by parallel changes in stratification. There was more talk in the easier second cycle and less stability and less hierarchization of sociometric ratings. There was less talk when teams carried packs on their backs, but stability and differentiation remained steady. In the hunger condition, less interaction was accompanied by a trend to greater differentiation in sociometric measures. These findings suggest a hypothesis of more stability and consensus when there is less informal interaction in newly-formed groups. In old, established groups the situation may be otherwise; friction engendered by the restraints of organized task-oriented interaction and less informal interaction may be disruptive to established structure.

Reduced informal interaction under different kinds of stress in this experiment was sometimes associated with changes in affect and integration. The slightly more strenuous pack-carrying task apparently did not upset these group attributes. On the other hand, work in the arduous first cycle entailed strains on team bonds of affection and consideration greater than in the somewhat less arduous second cycle. While talk remained relatively constant over time within cycles, the teams displayed some symptoms typical of developments in stressed groups: declining affect and integration, but good satisfaction with co-workers and team efforts, coupled with maintenance of informal differention and informal working relations.

In more extreme form the effects of hunger paralleled the inter-phase and inter-cycle differences in stress effects. However, there were some differences. Humor suffered much more drastically during hunger than during other forms of stress. Hostility to the observers did not increase during hunger, but complaining to them did. Possibly complaining might be perceived as a form of dependency rather than hostility. Sick call rates were higher among hungry groups. There was an accompanying breakdown in authority of the formal leaders and in task organization, which did not occur under the other stresses of time and task.

Most notable, however, as distinct effects of hunger were the emergence of cliques and the disappearance of order in noon seating (i.e., working relationships). These suggest a type of reaction specific to deprivation: a narrowing of relationships. The hungry men were too tired and irritable to accommodate interaction even with four others; certain members were rejected while bonds with others grew closer. This provided a tendency to increase sociometric differentiation under hunger, as suggested by the Hohn index values. It would account for the overt rejection of leaders' (or anyone else's) organizational attempts despite the clear advantages of work organization in terms of comfort and energy expenditures. Hungry teams were post-experimentally described as "bossy." With disappearance of relationships extended over the whole group and with failure of leader efforts, necessarily the ordering of an informal working structure would be difficult to maintain; order in the team was a matter of indifference as long as certain buddies could work and sit together. That ties between these buddies were as strong as any in full-fed teams is supported by post-experimental sociometric choices; hungry teams were at the same time rejected as badly organized.

The information on factor structure is suggestive. With less talk, with a narrower range of relationships, the hungry subjects also seemed to have more limited planes of reciprocity. It was as though the limited available energy for interaction in hungry groups was not sufficient to accommodate a multiplicity of planes of value. The development in full-fed groups of more specialized bases for peer judgment is in line with the reports of Hunt and Solomon (1942) and Lippitt (1948) that sociometric choices initially highly correlated with a few general attributes (e.g., performance capacity) later became more specific and differentiated.

The evidence suggests that instead of hunger breaking down structure, it inhibited development of structure in the newly-formed groups. The hungry groups seemed, as it were, more primitive and immature, unable to sustain extended or more specialized relationships. They never got off the ground. It was thus possible that contrast should be made between external stress vs. internal stress. It is one thing to increase the external burden on groups relative to constant resources (skills, energy, freedom for alternative communications structures); it is another to sabotage group potential by attacking its resources. Several experiments (e.g., Smith, 1958; Leavitt, 1951) have demonstrated how restrictions on internal communications have undermined loyalty and coordination in groups. On the other hand, increases in external demands often improve loyalty and coordination (Festinger, 1957), as was observed among Greenland subjects groups using the more difficult method of pack carrying.

It may be that as long as group facilities are maintained and member resources periodically replenished, moderate increases in external demand will not damage group structure and function. Usually, however, external stresses lead to depletions of group resources which cannot be immediately replaced. Groups may then regress, become more primitive, less able to satisfy member social and physical needs at the same time that the needs are increasing. To relieve social needs (Schacter, 1959) not accommodated by social units, members may revert to particularism (e.g., cliques) in associations; extended hierarchies of relationships in groups are abandoned. The groups become, as it were, collective confederations of sub-units rather than organic federations. If failure to replenish member need is blamed on collective inefficiency rather than outside forces, association between sub-units can disappear entirely (Torrance, La Forge and Mason, 1956) while ties within sub-units remain strong.

What people want most is to be responded to, loved, approved, and esteemed. If these needs can be gratified, the most important single condition of stability of a social system will have been met. "In the extreme case, which is relatively infrequent because of prior allocative processes, the primary or derivative need-dispositions are so pressing that no adaptation is possible and the expectations (of others) concerning the actor's behavior in a particular role in the division of labor are completely frustrated" (Parsons and Shils, 1951, pp. 150-152).

The Greenland experiment presented an extreme case for study. Food deprivation produced hunger discomfort, enhancement of other discomforts, and irritability, thereby placing strain on the integrative capacities of test groups already pressed by the external environment. Underfeeding also produced a sense of low available energy. The positing of available energy as a key variable in social organization has been the specific concern of a few students (e.g., Cottrell, 1955) and an explicit assumption of others (e.g., Thelen, 1954, p. 62; Argyris, 1961; Goode, 1960). Available energy for any given group activity is a function both of competing demands for energy in the group and of the amount of energy which members can (or are willing to) release to the group. Hunger has the joint effect of increasing demand for integrative support of members in discomfort, while decreasing energy available. By attacking both the numerator and denominator of the resource-demand ration, hunger probably has a more debilitating effect on groups than mere lethargy, such as that induced by sleeplessness (Murray _et al_., 1959), or pain and fear of pain (Fox, 1959), or hard work.

Practical implications

Groups hungry in the first cycle suffered more debilitation than those undergoing hunger later on. They seemed much more affected by "give-up-itis" (Kinkead, 1959). Sometimes when they encountered a minor obstruction they would drop in the snow and gaze at the trouble for minutes before rousing themselves to tackle it. Groups hungry in the second cycle displayed less lethargy; one team, indeed, seemed no more affected by hunger in the second cycle than by the difficulties of the first cycle when on full rations. This group had the most skilled leader, who was able to establish high standards of performance in the first cycle. On the other hand, when his team went hungry, he deliberately relaxed these standards. Deliberate relaxation of normal controls in times of stress also appears as policy in the Israeli Army (Marshall, 1958). "Willingness to disagree may mean the difference between survival and failure in groups" (Torrance, 1960). As Stogdill (1959, pp. 280, 284) summarizes,

> In concrete terms, this means that each member is permitted to perform near the outer bounds of his role . . . . The development of structural integrity under normal operating conditions, even at the expense of productive effectiveness, strengthens the group for times of crisis."

Men full-fed in the first cycle were able to develop good task organization, though at some cost in terms of tension, fatigue, and the like. The inter-cycle rest period permitted relief of these strains, so the men started out the second cycle relaxed but with a good idea of organization. Men hungry in the first cycle also started the second cycle in relaxed condition, but their social difficulties were greater because they had not had opportunity to learn effective organization. The considerable improvement in intra-team conditions noted in the second cycle thus appears attributable to the relaxation from activity allowed between cycles. This suggests that preparation before a stressful operation should include a period of escape from training pressures immediately before the operation itself.

Although personality attributes of participants have not been discussed in this report, there were indications that some men were less troubled than others by the effects of deprivation in the compulsory and total groups. Groups are often hard-pressed under stress to supply their members' affectional needs. It follows that men whose requirements for social support are less will suffer less from weakening of groups. A characteristic of such men is autonomy. In the U. S. Army Quartermaster project Chrystal Key I (Levin et al., 1962), soldiers ranking high in autonomy as measured by the Edwards Personal Preference Schedule (Edwards, 1959) were found to be consistently more often chosen as good performers and desired teammates both by their peers and by observers. Very similar results obtained from a study of men confined in the Antarctic for extended periods during the IGY (Smith, 1961); more autonomous, asocial men were preferred as performers and co-workers. These evidences suggest that measures of autonomy might well be used as criteria for selection of men for operations which may include stresses (e.g., hunger) weakening the social support facilities of groups.

Conclusions

One of the main aims of the Greenland experiment was to confirm quantitatively the reports of others concerning the phenomenological and social effects of hunger. Reliable confirmation was provided for some phenomenological effects: e.g., weakness, sensitivity to minor task increments, and concern about health and hygiene (hypochondriasis). On the other hand, alleged sensitivity to cold was unconfirmed, and sexuality appeared to be a concommitant of the general stress situation rather than a specific correlate of hunger. A recent study (Schonbach, 1958) suggesting that time passes more slowly for hungry men also was not supported by subjects' reports of time dragging.

Social effects of hunger on groups included reduced talk and humor, and increased complaining about minor strains. These effects were accompanied by consistent declines in measures on intra-team affect, task organization, and goal satisfaction. Measures of integration showed a mixed picture, in that negatively-toned items generally showed declining cooperation and interpersonal consideration while positively-toned items showed increases in these characteristics of integration. Sociometric ratings of teammates remained high under hunger, except ratings of leaders consistently were lower in hungry than in full-fed groups. There were more cliques, and rejections of members, in the sociometric matrices of hungry groups. Matrix entries remained stable and tended to show increased differentiation over time; hungry groups did not, however, maintain regular patterns of working relationships. Factor analyses of a set of sociometric ratings suggested simpler and less differentiated bases for interpersonal valuation in hungry groups.

Notable among the social findings was the contrast between effects of external demand stress and hunger deprivation stress. Subjects were untrained for Arctic work and found it extremely costly; the data show that integration and affect in all groups suffered in earlier stages of the experiment. Yet despite their troubles, groups were able to maintain stable relationships of organization and authority under conditions of high external demand. The onset of hunger, however, attacked group integrity by depriving members both of energy and of willingness to interact on group problems. The effect was equivalent to that one might produce in a laboratory by progressively breaking down communication links between members of a group until only an aggregate of diads remained. The hungry teams tended to become collective confederations rather than organic federations. In this sense, the absolute level of members' energy can be the prime asset, the fundamental resource of groups which enables them to function other than as aggregates.

Often implicit in discussion of effects of stress on groups is the presumption that increased member dissatisfaction and intragroup hostility disrupt organization and effectiveness and lead to the breakdown of groups into cliques. Almost all the expected social phenomena congruent with this assumption appeared in the hunger condition; the testing of such likely effects indeed was the second aim of the experiment. Yet one negative finding suggests that blaming group breakdown on interpersonal hostilities may not be wholely correct. No measure of subjects' respect for or congeniality with co-members as individuals showed a reliable decline under hunger stress. How would one then account for the disruption in the hungry groups? Maybe hungry individuals find it sheerly impossible to maintain a minimal group organization, because they are so tired and weak. With very little interaction energy to supply, they find it more economic to restrict reciprocity to just one or two co-members. This would be a matter of necessity, not of choice. Schacter (1959) has shown that hungry men display greater need for social support than full-fed men. With interaction resources very limited, men would reasonably choose to develop support relations with just one or two others rather than expose themselves to demands for reciprocity from all members; yet abstract valuation of all members might well remain high despite lack of interaction with them.

Corollary to this hypothesis would be difficulties in maintaining order in hungry groups. Communications to deviants, and application of sanctions against deviant members irritable with hunger, require energies which hungry men feel they lack. Accordingly there is less control in hungry groups. The observers in Greenland were impressed by a number of instances in hungry teams when physically able men, shirking their share of the work, were allowed to continue their defections without reprimand from others, while others did their work for them. Seemingly the latter found it easier to do physical work rather than to engage in attempts at compelling shirkers to work harder.

If indeed it is not intragroup hostility but rather inadequate resources for social support and control which lead to breakdown in deprived groups, then men less needful of social support and control should fare better in such groups. These men would be more autonomous; autonomy has been proposed by some students as a key requirement for effectiveness in societies having scanty regular facilities for socio-emotional support. This makes sense if one supposes that autonomous men, less troubled by lack of support from others, can offer more consistent social and task support to others during conditions of deprivation.

The third aim of the experiment, to gain clues on how constrained groups cope or fail to cope with hunger and work, thus may have been partly attained. If the key to group failure is not hostility but rather inadequate support and control facilities, so that members are deprived of the essential commodities of groups, then teams in which men customarily operate autonomously near outer bounds of their roles should sustain better the <u>social</u> deprivation which hunger brings. Loose organization for deprivation stress would be in contrast to the kind of tight organization effective in coping with increments in external demand. The possibility that different kinds of stress should be prepared for with different arrangements of social organization seems a possibility worth investigation.

LIST OF REFERENCES

Ambriere, F. The long holiday. Chicago: Ziff-Davis, 1948.

Anderson, N. H. Scales and statistics: Parametric and nonparametric. Psychol. Bull., 1961, 58, 305-316.

Argyris, C. New concepts of organizational structure and leadership. Invited address, American Psychological Association, New York, 1961.

Army Medical Nutrition Laboratory. The effect of vitamin supplementation on physical performance of soldiers residing in a cold environment. Chicago: U. S. Army Medical Nutrition Laboratory, 1953. (Report No. 115)

Aronsen, E., & Mills, J. The effect of severity of initiation on liking for a group. J. abn. soc. Psychol., 1959, 59, 177-181.

Atkinson, J. W. Towards experimental analysis of human motivation in terms of motives, expectancies, and incentives. In J. W. Atkinson (Ed.), Motives in fantasy, action and society. Princeton, N. J.: Van Nostrand, 1958. Pp. 288-305.

Atkinson, J. W., & McClelland, D. C. The effect of different intensities of the hunger drive on thematic apperception. In J. W. Atkinson (Ed.), Motives in fantasy, action and society. Princeton, N. J.: Van Nostrand, 1958. Ch. ii.

Back, K. W. The exertion of influence through social communication. J. abn. soc. Psychol., 1951, 46, 9-23.

Bales, R. F. Adaptive and integrative changes as sources of strain in social systems. In A. P. Hare, E. F. Borgatta, & R. F. Bales (Eds.), Small groups. New York: Knopf, 1955. Pp. 127-131. (a)

Bales, R. F. The equilibrium problem in small groups. In A. P. Hare, E. F. Borgatta, & R. F. Bales (Eds.), Small groups. New York: Knopf, 1955. Pp. 424-456. (b)

Bales, R. F. & Borgatta, E. F. Size of groups as a factor in the interaction profile. In A. P. Hare, E. F. Borgatta, & R. F. Bales (Eds.), Small groups. New York: Knopf, 1955. Pp. 396-413.

Bass, B. M. Leadership, psychology and organizational behavior. New York: Harper, 1960.

Benedict, F. G., Miles, W. R., Roth, P., & Smith, H. M. Human vitality and efficiency under prolonged restricted diet. Washington, D. C.: Carnegie Institute, 1919. (Publication No. 280)

Bettleheim, B. Individual and mass behavior in extreme situations. In Eleanor E. Maccoby, T. M. Newcomb, & E. J. Hartley (Eds.), Readings in social psychology. (3d ed.) New York: Holt, 1958. Pp. 300-310.

Blair, J. R., et al. Preliminary observations on physiological, nutritional, and psychological problems in extreme cold, Fort Churchill, Canada (winter, 1946-1947). Fort Knox, Ky.: U. S. Army Medical Department Field Research Laboratory, 1947.

Blau, P. M. Formal organization: Dimensions of analysis. Amer. J. Sociol., 1957, 63, 58-69.

Blau, P. M. A theory of social integration. Amer. J. Sociol., 1960, 65, 545-556.

Bondy, C. Problems of internment camps. J. abn. soc. Psychol., 1943, 38, 453-475.

Boneau, C. A. The effects of violations of assumptions underlying the t test. Psychol. Bull., 1960, 57, 49-64.

Buskirk, E. R. Standard work tests in man: Some illustrative results. In H. Spector, J. Brozek, & M. S. Peterson (Eds.), Performance capacity. Chicago: U. S. Army Quartermaster Food & Container Institute for the Armed Forces, 1957. Pp. 115-131.

Bovard, E. W. The experimental production of interpersonal affect. J. abn. soc. Psychol., 1951, 46, 521-528.

Castro, L. The geography of hunger. Boston: Little-Brown, 1952.

Cliff, N. Adverbs as multipliers. Psychol. Rev., 1959, 66, 27-44.

Cohen, E. A. Human behavior in the concentration camp. New York: Norton, 1953.

Cohen, J. Food and its vicissitudes. Unpublished ms., 1955.

Coser, Rose L. Insulation from social observability and types of social conformity. Amer. sociol. Rev., 1961, 26, 28-39.

Cottrell, F. Energy and society. New York: McGraw-Hill, 1955.

Cronback, S. J., & Glesser, G. C. Similarity between persons and related problems of profile analysis. Urbana, Ill.: University of Illinois, College of Education, Bureau of Research and Service, 1952. (Technical Report No. 2)

Deutsch, M. The effects of cooperation and competition upon group process. In D. Cartwright, & A. Zander (Eds.), Group Dynamics. Evanston, Ill.: Row, Peterson, 1953. Pp. 319-353.

Dyme, H. C. Arctic field trial of USAF survival patterns, Blair Lake, Alaska, January 1950. Dayton, Ohio: U. S. Air Force, Air Materiel Command, Aeromedical Laboratory, 1950. (Technical Report No. 6019)

Edwards, A. L. Edwards Personal Preference Schedule. New York: Psychological Corporation, 1959. (Manual)

Edwards, D. S. The constant frame of reference problem in sociometry. Sociometry, 1948, 11, 372-379.

Eilbert, L. R. & Glaser, R. Differences between well and poorly adjusted groups in an isolated environment. J. appl. Psychol., 1959, 43, 271-274.

Eren, T. D., & Auld, F. A study of the thematic apperception test stories and sentence completion of subjects in operation hideout. New London, Conn.: U. S. Navy, Submarine Medical Research Laboratory, 1954. (Report No. 243)

Festinger, L. A theory of cognitive dissonance. Evanston, Ill.: Row, Peterson, 1957.

Fox, Renée, Experiment perilous: Physicians and patients facing the unknown. Glencoe, Ill.: Free Press, 1959.

Fouriezos, N. T., Hult, M. L., & Guetzkow, M. H. Measurement of self-oriented needs in discussion groups. J. abn. soc. Psychol., 1950, 45, 682-690.

Franklin, J. C., Schiele, B. C., Brozek, J., & Keys, A. Observations on human behavior in experimental starvation and rehabilitation. J. clin. Psychol., 1948, 4, 28-45.

French, E. G. Motivation as a variable in work-partner selection. J. abn. soc. Psychol., 1956, 53, 96-99.

French, J. R. P. The disruption and cohesion of groups. In D. Cartwright, & A. Zander (Eds.), Group Dynamics. Evanston, Ill.: Row, Peterson, 1953. Pp. 121-134.

French, R. L. Sociometric status and individual adjustment among naval recruits. J. abn. soc. Psychol., 1951, 46, 64-72.

Freuchen, P. Arctic adventure: My life in the frozen north. New York: Farrar & Rhinehart, 1935.

Freud, S. Group psychology and the analysis of the ego. London: Hogarth Press, 1949.

Gerard, H. B. The effects of two dimensions of disagreement on the influence process in small groups. Hum. Relat., 1953, 6, 249-271.

Goffman, E. The presentation of self in everyday life. Edinburgh: University of Edinburgh, Social Sciences Research Center, 1956. (Monograph No. 2)

Goffman, E. The characteristics of total institutions. In Walter Reed Army Institute of Research, & National Research Council (Sponsors), Symposium on preventive and social psychiatry. Washington, D. C.: U. S. Government Printing Office, 1958. Pp. 43-84.

Goode, W. J. A theory of role strain. Amer. sociol. Rev., 1960, 25, 483-496.

Guetzkow, M. H. & Bowman, P. H. Men and hunger. Elgin, Ill.: Brethren Publishing House, 1946.

Guilford, J. P. Psychometric methods. New York: McGraw-Hill, 1954.

Hamsun, K. Hunger. New York: Knopf, 1921.

Harris, W., Mackie, R. L., & Wilson, C. L. Performance under stress: A review and critique of recent studies. Washington, D. C.: U. S. Navy, Office of Naval Research, Psychological Sciences Division, Personnel and Training Branch, 1956. (Technical Report No. VI)

Hohn, F. E. Some methods of comparing sociometric matrices. Urbana: University of Illinois, College of Education, Bureau of Research and Service, 1953. (Technical Report No. 5)

Holmberg, A. Nomads of the long-bow. Washington, D. C.: U. S. Government Printing Office, 1950. (Institute of Social Anthropology Publication No. 10)

Homans, G. C. The human group. New York: Harcourt, Brace, 1950.

Homans, G. C. Social behavior: Its elementary forms. New York: Harcourt, Brace, 1961.

Hunt, J. McV., & Solomon, R. L. The stability and some correlates of group-status in a summer camp group of young boys. Amer. J. Psychol., 1942, 55, 33-45.

Jacobsen, E. Observations on the psychological effect of imprisonment on female political prisoners. In K. R. Eissler (Ed.), Searchlights on delinquency. New York: International Universities Press, 1949. Pp. 341-368.

Jenkins, W. O. Review of leadership studies with particular reference to military problems. Psychol. Bull., 1947, 44, 54-79.

Kardiner, A. The individual and his society. New York: Columbia Univer. Press, 1939.

Katz, D. Survey research center: An overview of the human relations program. In M. H. Guetzkow (Ed.), Groups, leadership and men. Pittsburgh: Carnegie Press, 1951. Pp. 68-85.

Kelley, H. H. Communication in experimentally created hierarchies. In D. Cartwright, & A. Zander (Eds.), Group dynamics. Evanston, Ill.: Row, Peterson, 1953. Pp. 443-461.

Keys, A., Brozek, J., et al. The biology of human starvation. Minneapolis: Univer. Minnesota Press, 1950. (2 vols.)

Kinkead, E. In every war but one. New York: Norton, 1959.

Klein, J. The study of groups. London: Rutledge and Kegan Paul, 1956.

Lanzetta, J. T., Haefner, D., & Axelrod, H. Some effects of situational threat on group behavior. J. abn. soc. Psychol., 1954, 49, 445-453.

Leavitt, H. Some effects of certain communication patterns on group performance. J. abn. soc. Psychol., 1951, 46, 38-50.

LeBlanc, J. A. Heart rate as an index of performance under field conditions. In H. Spector, J. Brozek, & M. S. Peterson (Eds.), Performance capacity. Chicago: U. S. Army Quartermaster Food & Container Institute for the Armed Forces, 1961. Pp. 62-67.

Lebo, L. Measuring group cohesiveness. Ann Arbor: University of Michigan, Institute for Social Research, Research Center for Group Dynamics, 1953.

Levin, A., Peryam, D. R., Seaton, R., Morana, N., & Hastings, A. Systems research in "micrologistics" and human factor aspects of small group capabilities in a polar area. Natick, Mass.: U. S. Army Quartermaster Research & Engineering Center, 1962. (Quartermaster Polar Research Project PPO-59)

Lewin, K. Time perspective and morale. In K. Lewin, Resolving social conflicts. New York: Harper, 1948. Pp 120-153.

Lewin, K. Field theory in social science. New York: Harper, 1951.

Leyton, G. B. The effects of slow starvation. Lancet, 1946, 2, 73-79.

Lindeman, H. Alone at sea. New York: Random House, 1958.

Lindsay, P. Sledge. London: Longmans, 1935.

Lippitt, R. A program of experimentation in group functioning and group productivity. In W. Dennis (Ed.), Current trends in social psychology. Pittsburgh: Univer. Pittsburgh Press, 1948. Pp. 14-49.

Lippitt, R., Polansky, N., Redl, F., & Rosen, S. The dynamics of power: A field study of social influence in groups. In Eleanor E. Maccoby, T. M. Newcomb, & E. L. Hartley (Eds.), Readings in social psychology. (3d ed.) New York: Holt, 1958. Pp. 251-264.

Lipscomb, F. M. Medical aspects of Belsen concentration camp. Lancet, 1945, 2, 313-315.

Loehlin, J. C. The influence of different activities on the apparent length of time. Psychol. Monogr., 1959, 73 (4, Whole No. 474).

Loomis, C. P., & Loomis, Eona. A case of failure in the achievement of goals. Sociometry, 1955, 18, 302-326.

Luce, D. Connectivity and generalized cliques in sociometric group structure. Psychometrika, 1950, 15, 169-190.

Marquis, D. G., Guetzkow, H., & Heyns, R. W. A social psychological study of the decision-making conference. In M. H. Guetzkow (Ed.), Groups, leadership, and men. Pittsburgh: Carnegie Press, 1951. Pp. 55-67.

Marshall, S. L. A. Sinai victory. New York: Morrow, 1958.

Mechanic, D., & Volkart, E. H. Stress, illness behavior, and the sick role. Amer. sociol. Rev., 1961, 26, 51-58.

Mellin, H. Organizational practice and individual behavior: Absenteeism among psychiatric aids. Amer. sociol. Rev., 1961, 26, 14-23.

Military Planning Division. Summary of ration tests and surveys as related to environment. Chicago: U. S. Army Quartermaster Food & Container Institute for the Armed Forces, 1951.

Mills, T. M. Power relations in three-person groups. In D. Cartwright, & A. Zander (Eds.), Group dynamics. Evanston, Ill.: Row, Peterson, 1953. Pp. 428-442.

Murray, E. J., Schein, E. H., Erikson, K. T., Hall, W. F., & Cohen, M. The effects of sleep deprivation on social behavior. J. soc. Psychol., 1957, 49, 229-236.

Nardini, J. E., Herrmann, R. S., & Rasmussen, J. E. Navy psychiatric assessment program in the antarctic. Washington, D. C.: U. S. Navy, Bureau of Medicine and Surgery, 1961.

Nelson, P. D., & Gundersen, E. K. E. Attitude changes in small groups under prolonged isolation. Paper read at American Psychological Association, New York, 1961.

Newcomb, T. M. Social psychology. New York: Dryden Press, 1954.

North, R. C., Koch, H. E., & Zinnes, Dina A. The integration functions of conflict. Conflict Resol., 1960, 4, 355-374.

Parsons, T., & Shils, E. A. (Eds.), Toward a general theory of action. Cambridge: Harvard Univer. Press, 1951.

Peary, R. E. Northward over the great ice. New York: Stokes, 1898.

Proctor, C. H., & Loomis, C. P. Analysis of sociometric data. In Marie Jahoda, M. Deutsch, & S. W. Cook (Eds.), Research methods in social relations. New York: Dryden, 1951. Pp. 561-585.

Richards, Audrey T. Hunger and work in a savage tribe. Glencoe, Ill.: Free Press, 1948.

Ruesch, J. Values and the process of communication. In Walter Reed Army Institute of Research, & National Research Council (Sponsors), Symposium on preventive and social psychiatry. Washington, D. C.: U. S. Government Printing Office, 1958. Pp. 27-40.

Ruff, G. E., & Levy, E. Z. Psychiatric research in space medicine. Amer. J. Psychiat., 1959, 116, 793-797.

Schacter, S. The psychology of affiliation. Palo Alto, Calif.: Stanford Univer. Press, 1959.

Schonbach, P. Cognition, motivation, and time perception. J. abn. soc. Psychol., 1958, 2, 195-202.

Schutz, W. C. FIRO: A three-dimension theory of interpersonal behavior. New York: Holt, Rinehart, & Winston, 1958.

Scott, E. L. Leadership and the perception of organization. Columbus: Ohio State University, Bureau of Business Research, 1950. (Monograph No. 82)

Shils, E. A. & Janowitz, M. Cohesion and disintegration in the Werhmacht in World War II. Publ. opin. Quart., 1948, 12, 280-315.

Siegel, S. Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill, 1956.

Slater, P. E. Contrasting correlates of group size. Sociometry, 1958, 21, 129-139.

Smith, E. E. Choice of own vs. group attainment under threat and reduced threat and in overt and covert conditions. J. abn. soc. Psychol., 1958, 56, 429-439.

Smith, W. M. Scientific personnel in Antarctica: Their recruitment, selection and performance. Psychol. Rep., 1961, 9, 163-182.

Sorokin, P. A. Man and society in calamity. New York: Dutton, 1942.

Stogdill, R. Individual behavior and group achievement--a theory: The experimental evidence. New York: Oxford Univer. Press, 1959.

Taguiri, R., Kogan, N., & Bruner, J. S. The transparency of interpersonal choice. Sociometry, 1956, 18, 624-635.

Thelen, H. Dynamics of groups at work. Chicago: Univer. Chicago Press, 1954.

Thibaut, J. U., & Kelley, H. H. The social psychology of groups. New York: Wiley, 1959.

Torrance, E. P. Group decision-making and disagreement. Soc. Forces, 1957, 35, 314-218. (a)

Torrance, E. P. What happens to the sociometric structure of small groups in emergencies and extreme conditions. Group Psychotherapy, 1957, 10, 212-220. (b)

Torrance, E. P. Leadership in the survival of small isolated groups. In Walter Reed Army Institute of Research, & National Research Council (Sponsors), Symposium on preventive and social psychiatry. Washington, D. C.: U. S. Government Printing Office, 1958. Pp. 309-327.

Torrance, E. P. A theory of leadership and interpersonal behavior under stress. Unpublished paper, 1959.

Torrance, E. P. Behavior in emergencies and extreme conditions. Unpublished ms., 1960.

Torrance, E. P., LaForge, G. R., & Mason, R. Group adaptation in emergencies and extreme conditions. Randolph Air Force Base, Texas: U. S. Air Force Office of Social Science Programs, Personnel and Training Research Center, 1956. (Technical Memorandum No. 56-4)

Whitlock, G. H. & Cureton, E. E. Validation of morale and attitude scales. Lackland Air Force Base, Texas: U. S. Air Force Air Research and Development Command, Wright Air Development Division, Personnel Laboratory, 1960. (Technical Report WADD-TR-60-76)

Zimmer, H. A test program for two Antarctic expeditions: 1956-1959. Washington, D. C.: Georgetown University Medical Center, 1958. (Contract Nonr 1530 [06])

APPENDIX A

HISTORY OF THE EXPERIMENT

Preliminary Phases

Introduction

A spelling out of the actual sequence of test details is necessary because in the unique setting of the experiment all details became important to the men and potentially influenced their personal and social behavior. In experiments in laboratories, the reader can assume that details not specified were "normal," e.g., that the color of the walls of the laboratory was a neutral shade rather than shocking pink, or that if the clocks on the walls were inaccurate, this did not matter to subjects. In field experiments such as the one in Greenland, nothing is normal and nothing is unimportant to subjects undergoing environmental stress. The entire circumstances surrounding the test--weather, timing, administration, instruments, facilities--are exceptions from the usual perceptual world of the subjects and are heightened in importance as potential bases for this or that kind of behavior on their part. In the succeeding sections circumstances of this experiment are described so as to form a concrete setting within which quantitative data presented may be interpreted.

Selection characteristics and early preparation of subjects

Chapter III included a discussion of this topic, in which the point was made that the test subjects mostly were not volunteers. Willingness to participate was reported as moderate to low by most subjects. Contributing to this low acceptance were negative reports from Fort Lee soldiers who had participated in Quartermaster test exercises on the Greenland Icecap in 1959.

Availability was necessarily a criterion in the decision about who among potential test personnel at Fort Lee would be sent to Greenland. Thus, although the test plan called for team leaders to be sergeants, the four NCO's selected as leaders included only one sergeant with two corporals and one acting corporal. In initial examinations for physical fitness, fairly lenient criteria were applied. Age over thirty years and minor malformations and disabilities were not used as disqualifiers. In no sense could the subjects be said to comprise an elite.

Some characteristics of the 20 men selected for the trek are shown in Table 19. The data show that test subjects were generally young, husky, moderately educated, of lower class origins, from large families located east of the Mississippi, and with about two years of military service. These characteristics do not appear atypical of the Army enlisted population.

Training in use of Arctic gear and conditioning marches were undertaken over a period of about ten days at Fort Lee before subjects' departure. It was, however, reportedly difficult to enlist subjects' interest in this preparation for Arctic life during the June heat of Virginia. Possibly contributing to this disinterest in training was the necessity of restricting information on what the subjects were expected to do in Greenland. The men were told that they would march and camp on the Icecap, but they were not told of the experimental conditions they would undergo. This restriction was applied to avoid possible distortion and exaggeration of exactly what was to be expected of subjects during the experiment, which might lead to premature discouragement. Also, due to pressure of other duties plus earned leave opportunities, the 28 enlisted men selected for transport to Greenland (24 to man proposed six-man teams, plus four supernumeraries) missed an average of about a day and a half of pretest training. These several factors contributed to subjects' being somewhat less than optimally prepared physiologically and psychologically for the rigors of the coming trek.

TABLE 19

CHARACTERISTICS OF TEST SUBJECTS

Age	Mean 21 years; range 19-23 years
Weight (in U.S.)	Mean 169 lbs.; range 145-217 lbs.
Education	Mean 11.2 years; range 9-13 years
Years in military service	Mean 1.5 years; range 7 months-3+ years
Education of father	Mean 9.6 years; range 4-13 years
Number of siblings (including selves)	Mean 4.75; range 1-10
Sibling position	3 "only" children; 6 eldest; 7 "middle"; 4 youngest
Occupation of fathers	16 manual or industrial laborers; 4 service workers
Region of origin	11 mid-Atlantic and New England states; 9 Midwest and South
Size of home town	9 large cities; 11 small towns and rural areas
Previous Arctic experience	5 with 3-6 months; 15 with none

Transport of subjects to test site

There was some delay in transportation of test troops to Greenland, because the main air base on the northern Greenland coast (Thule) was frequently fogged in. In lieu of all 28 subjects flying together in a single aircraft, it was found more feasible to split them into three groups to arrive in Thule on three successive days beginning on 2 July. Fog somewhat delayed the arrival of the first two contingents of test subjects, and departure of the third contingent from the United States was held up by engine trouble so long that they missed departure of the over-Icecap snow train scheduled for 5 July. They were however, later able to catch up with the snow train enroute by means of helicopter and small oversnow vehicles.

The weather in early July was warm, so that the snow towards the edge of the Icecap was very slushy and held up progress of the snow train. In the first three days the train was able to advance only 100 miles; it was not until 11 July that it arrived at base camp (Camp Fistclench). The test at this point was almost a week behind its original scheduling.

On-site preparation of test subjects

The delay in getting the men on-site exerted direct cost to the on-site training program. The buildup of subjects to marching fitness, after their days of enforced indolence while in transport, had to be speeded up. The first few days were spent issuing cold-weather marching equipment and instructing on equipment use in snow. Short (e.g., two miles unloaded) snowshoe marches were scheduled, with subsequent development by some men of "snowshoe legs" (a strain of the muscles of the inner thigh resulting from walking with feet spread apart on snowshoes). Even these short marches were tiring, due partly to the delay in acclimation to the 7,000-foot altitude. Slowly there was a buildup in the scope of exercises required. Each increase brought a new wave of subjects in for sick call. On one day, 26 of the 28 subjects reported sick or disabled. While most complaints were

Fig. 12.--The fleet of wanigan trains which hauled the men to the test site. This trip took six days. The trail here curves to avoid a crevasse area at mile 12.

minor (blisters, muscle aches, sunburn) it became clear that a firm line would have to be drawn on the legitimacy of complaints if loss of a majority of test subjects to disability was to be avoided.

During the first few days after arrival at Camp Fistclench, an extended orientation was held for subjects on all major and minor aspects of the proposed test operation. Scientific or practical justifications of these aspects were provided at the end of orientation. The structure of the experiment appeared to be clear to the subjects.[18] One aspect of the test structure was deliberately mis-stated. The men were told that the test would consist of three cycles, rather than the two actually scheduled. The third cycle was to include vehicular rather than foot march; otherwise details of the "third cycle" were not spelled out. The purpose of this mis-statement was to offset the "end effect" observed in similar experiments (e.g., Army Medical Nutrition Laboratory, 1953), when morale and activity tended to rise with the approaching end of a test.[19] To avoid later charges of bad faith, it was planned that the terminal over-snow transport to the coast after test completion would be termed the "third cycle," during which final interviews could be held. Among the 28 test subjects and alternates were five men who had spent the previous summer in Greenland. These were generally antagonistic to participation in the test and, being experienced with Icecap marching, could lead the direction of critical and skeptical questions about the test.

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[18]"The writer gained emotional strength from the following facts: that things happened according to expectation . . ." (Bettelheim, 1958).

[19]See, for example, Tables 22 and 24 of the study by the Army Medical Nutrition Laboratory (1953), in which dropout and sick-call rates dropped sharply in the last week of the study, despite continuously severe conditions.

Their resistance negatively colored acceptance of the test program, on the part of the remaining more naive subjects, into passive resignation.[20] This lack of enthusiasm, coupled with the strains of physical acclimation, led some subjects to emphasize their physical incapacity for the task ahead. The justice of some cases had to be recognized; for example, a number of men over thirty years old found the going extremely rough. Four men had to be dropped from the line-up and sent home. This forced a reduction in the number of subjects in test teams from six to five, for a total of 20 rather than the planned 24 subjects.[21] Four other men stayed on as auxiliaries.

Allocation of subjects to teams

Within the limitations of time and the difficult field conditions at the time it became necessary to make team allocations, only three formal criteria could be expediently applied to the problem. The first was Arctic experience: all teams (including those resulting from switching of team

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[20] Also affecting morale during pretest activities was the recall to the United States of a popular officer who had been assigned to participate in the leadership of the test.

[21] Implications of this modification upon the test conditions and statistical design are several. First, the reduction in team size meant that five men had to do the work planned for six; this meant that each man probably had to work a little harder. An offsetting factor was that five men now enjoyed the tent space and fuel allowance designed for six. There is evidence (Whitock and Cureton, 1960; Slater, 1958; Bales and Borgatta, 1955) also, that five-man groups are more stable and satisfying and less likely to split into cliques than are six-man groups. A disadvantage of this change was that it made questionable the assumption (see Appendix B) that subgroups assigned to teams equally spread their characteristics over all team co-members, since the follower subgroups (n=3) were now larger than leader subgroups (n=2) from which one member had been deleted. However, the presence of the leader in the leader subgroups was assumed to offset the numerical dominance of the follower subgroups.

memberships at the beginning of the second cycle) were to include at least one of the five men who had previous Arctic experience. The second was weight: teams should be approximately balanced in sled-pulling and pack-carrying power. The third was sociometric choice, to avoid some teams being made up of well-coordinated and cohesive cliques while others were composed of disparate individuals without social ties. Thus, sociometric choices for preferred teammates, obtained before team allocation, were used negatively to break up mutual choices.

Table 20 shows data on member characteristics of the teams and of the leader and follower subgroups composing different teams in each of the two cycles (that is, both before and after switching of team memberships midway in the test). Inspection of the table shows clearly that the allocations were less than optimal, notably in terms of the imbalance of sociometric choices received by members of the different teams. As might be suspected, this imbalance was a result of the process of allocation. More "socially-salient" individuals came up first for consideration for team allocation in terms of the three criteria and were allocated to the first two teams, while the second two teams received the more-inconspicuous "remainder." As can be seen in the tables giving experimental results (Appendix C) this failure in balancing of allocations between the first two and second two teams had significant repercussions on the obtained data.

Perhaps as significant was the assignment of team leaders. Two of the four legitimate NCO's were among those relieved from trail duty due to physical incapacity. Of the two remaining NCO's one was assigned to A-team and one to C-team. The one heading A-team had previous Arctic experience; the one heading C-team had not. B-team included two men with previous Arctic

TABLE 20

TEAM CHARACTERISTICS AND CHARACTERISTICS OF LEADER AND FOLLOWER SUBGROUPS COMPOSING TEAMS

Characteristic	1st Cycle Teams (n=5)				2nd Cycle Teams (n=5)			
	A	B	C	D	A'	B'	C'	D'
Initial level of interest in the Greenland test	3.4	4.4	3.0	4.2	4.4	3.4	4.0	3.2
Age (based on half year added to each reported age)	20	21	21	22	21	20	22	21
Weight (before departure from U.S.)	164	176	172	166	180	159	167	171
Number of members in previous Arctic expedition	1	2	1	1	1	2	1	1
Number of high-school graduates (all others did not complete high school)	2	2	2	3	3	1	2	3
Number with 3 or more living siblings	4	2	2	5	2	4	4	3
Number with fathers in census class 2 (all others in class 1)	1	1	2	0	0	2	1	1
Number with one year of active service (none had 4 years)	3	2	4	4	2	3	4	4
Number having mainly urban upbringing	3	2	3	1	2	2	2	2
Number of pretest sociometric choices received by members as preferred teammates	25	22	11	11	25	22	13	9
Average years of military service	1.8	1.0	2.1	1.9	1.7	1.8	2.1	1.9

TABLE 20--Continued

Characteristic	Leader Subgroups (n=2) a'	b'	c'	d'	Follower Subgroups (n=3) a"	b"	c"	d"
Initial level of interest in the Greenland test	4.0	4.0	4.0	4.5	3.0	4.7	2.3	4.0
Age (based on half year added to each reported age)	20	20	23	23	20	21	20	21
Weight (before departure from U.S.)	178	166	177	173	155	182	169	161
Number of members in previous Arctic expedition	1	2	0	0	0	0	1	1
Number of high-school graduates (all others did not complete high school)	1	0	1	2	1	2	1	1
Number with 3 or more living siblings	1	1	1	2	3	1	1	3
Number with fathers in census class 2 (all others in class 1)	0	1	1	0	1	0	1	0
Number with one year of active service (none had 4 years)	2	2	1	1	1	0	3	3
Number having mainly urban upbringing	1	1	1	0	2	1	2	1
Number of pretest sociometric choices received by members as preferred teammates	14	11	5	3	11	11	6	8
Average years of military service	2.5	1.5	2.2	1.8	1.0	.8	2.0	2.0

experience; one was clearly the leader of subjects' resistance to the test, so the other was put in charge. This was later to lead to difficulties, as the dissident established himself as the stronger of the two men and was able to usurp dominance from the temporarily-appointed leader.

Finally, among the five men assigned to D-team, one was nominated as acting corporal pro tem on the basis of his apparent strength, self-reliance, keenness, and competence. Sociometrically he was neutral, being neither chosen nor rejected on most attributes. His only competitor for the leadership assignment was a D-team member with previous Arctic experience; this other man was adjudged by his superiors to be too immature for the job (he was nineteen). However, in making the leadership assignment in D-team, one fact was overlooked: the man chosen had only a few months in service and was only a private, while most test subjects were privates first class. This fact furthered the weakness of the necessarily temporary leadership assignment in D-team, despite the appointee's subsequently-established personal conscientiousness and competence.

Final preparations

With team allocations completed, final conditioning and shakedown of the test teams was to have progressed intensively so that they would be adequately prepared to meet the rigors of the forthcoming trek. At this time, however, an unusually heavy snowstorm invaded the high-pressure area usual on the mid-Icecap in midsummer. Coastal installations were damaged by the storm, and on the Icecap surface work was halted. Test subjects stayed huddled 'round stoves in their trail tents waiting for the blow to pass. After a day of this, they were removed from the field exercise site back to more comfortable under-snow quarters at the base camp. The storm continued for a second day (22 July), while the subjects got a good rest from the misery of pre-test training exercises. They enjoyed the camp's movies and soft drinks; their physical disabilities (overstrained muscles, etc.) eased; and their outlook brightened. The only blot on the schedule for them was practicing the Harvard Step Test, an index of physical fitness which was measured for record just before and just after each cycle. The test is short but strenuous and monotonous, and the men did not like having to practice proficiency in it. This practice, however, was about all the physical exercise they received immediately before inception of experimental phases of the operation.

On 23-24 July final preparations for the trek were made, physiological measurements taken, and bellies stoked with base camp food. On 25 July the first march began.

Commentary

These preliminary aspects of the experiment have been spelled out so as to form a context within which subsequent results may be interpreted. The central feature in this context would appear to be its absence of structure. Very few events that the subjects experienced after their departure from the United States could be regarded as "normal." The omnipresent hierarchy of established military commissioned and non-commissioned authority and resources, under which these men normally performed their duties, was remote and symbolically represented only by a field grade officer and one senior sergeant. Assigned team leaderships lacked full sanctions for acceptance, either in terms of experience, race, rank, or official documentation of status. Higher authorities, to which one might appeal for amelioration of arbitrary decisions, were geographically too remote for access.

This remoteness was emphasized by the ten days of sporadic travel, in a very mixed lot of vehicles, which the subjects underwent between their departure from Fort Lee, Virginia, and the test site. Announced travel schedules unavoidably were frequently changed due to the failure of equipment or arbitrariness of the environment. Yet when the environment was benign, it offered nothing except a cold, brilliant blankness. The altitude and snow made movement physically costly. Living in the under-snow darkness of the base camp was dampening. Facilities in the base camp were relatively primitive, and subject to occasional failure. Normal minor gratifications (a deck of cards, a letter, a bottle of soda) were hard to acquire.

This informal discussion of preparation of the subjects may aptly close with quotation of notes taken by an observer at the time:

> In sum, the blankness, remoteness, and hostility of this environment appears to carry implications similar to those one might expect (in more extreme form) under anarchy, coupled with loss of societal organization and regularized, role-ritual interpersonal contacts. Most of our men are not volunteers--as such, they differ distinctly from the great preponderance of men who have been in the Arctic. Volunteers for any difficult or unusual duty surely must be characterized by ego-strength and autonomy--these may be just the types who are relatively immune to reduction in external physical and social structuring. Accordingly the debilitating effects of the blankness of the Arctic, tantamount to sensory deprivation conditions in the laboratory, may have been underestimated in the previous literature.

Experimental Phases

The previous section of this appendix detailed the preparations and arrangements before the experimental phases of the test as these might relate to subsequent experimental observations. This section discusses details in the conduct of the experimental phases themselves which bear possibly significant relationships to observations recorded.

Early strains and adjustment

The first experimental phase of the test called for a march away from the base camp for seven days at a rate of ten miles per day beginning on 25 July. On that day, however, a decision was made to reduce the required daily march to eight miles. Two factors supported this decision. First, the July weather on the Icecap had forced delays in transportation to the test site and otherwise retarded adequate conditioning of the test subjects. Second, attrition among test subjects led to the requirement that teams of five men do the work originally scheduled for six.

A third, marginal factor which may have contributed to the reduction in daily march was the unfriendly quality of the weather on 25 July, the first day of the marching; it was cold, windy, and overcast.

The weather deteriorated further on 26 July. A blowing snowstorm reduced visibility to four-tenths of a mile. Tired from their previous day's unaccustomed exercise, the teams plodded along slowly, worrying about blisters developing from the unaccustomed snowshoes. Though the teams were bunched up, no comment passed between them; only occasional mutters broke the silence. That night twelve of the twenty men reported on sick call with sore feet and legs and complaints of indigestion and coughs. Salient among other complaints of the men at this time was, first, the standing of guard watches throughout the night by each team, without the use of stoves for warmth after 10:00 P.M. The subjects could not see how this requirement either made a contribution to the scientific purposes of the operation or was required in the isolated setting. Secondly, the men disliked the use of respirator masks measuring air intake under various work conditions. The men claimed that these masks stifled them severely, although laboratory evidence had shown that the masks increased resistance to air flow only by a few percentage points.

These and other observations of deterioration of fitness and morale among the subjects during the early days of the first cycle threw considerable doubt on whether they would be able to stay the course. If one subject reached a point of collapse and had to withdraw from the experiment, it was feared that "give-up-itis" contagion would spread. On 27 July the test administrators felt compelled to reduce the length of test phases (outbound or inbound marches) from the seven days originally scheduled to five days. On 28 July, guard duty was dropped from the daily proceedings. At about the same time mechanical failure and unreliability were noted in the respirator masks; use of the masks, therefore, was halted for the remainder of the first cycle.

These several rearrangements appeared to hearten the subjects and they were further encouraged by attainment on the fifth day of the turnaround point 40 miles from the base camp. The sick call rate dropped to three or four per day. At the same time the teams grew more autonomous and responded well to instructions to march more spread out along a lateral front. The rate of movement increased so that subjects regularly setting out at 8:30 A.M. were able to attain the four-mile lunch halt by 11:30 and complete their daily eight-mile quota by 3:00 P.M.

Life on the trail

Before the dropping of use of respirator masks in the first cycle, and during the second cycle, the daily activities of teams on the trail followed a similar pattern. Shortly after 9:00 A.M. physiologists and technicians would join two of the four teams as they marched, apply masks to team members, and time and record their activity while the masks were on. Breaks, usually taken every 20 minutes or so, were taken by subjects with the masks on. Between 10:30 and 11:00 A.M. the slow but steadily moving wanigan train would catch up with the moving teams. The physiologists and technicians at this time rejoined the wanigan, and social scientists took over as observers. The wanigan train then moved ahead to halt at the four-mile point marking the lunch stop. During the 45-minute period before lunch the social scientists administered various tests, recording responses of the marching subjects on tape, and made various observations on rate of movement, special relations between teams, communication rate within teams, etc. The social scientists stayed with the teams through the noon break, recording seating arrangements, preparation of wind-breaks, feeding procedures, and content and flow of conversation in teams. At the time that the teams were ready to move out after lunch, the physiologists and technicians with respirator masks replaced the social scientists, who then joined the wanigan train as it moved ahead to mark the halting point for the day's march. When the teams arrived at this point in early afternoon, the two sets of observers again changed places, the social scientists this time recording camp-setting operations and timing, and the amount, content, and direction of communication. The teams were alone in their tents during preparation and eating of supper, after which observers joined some teams in their tents for administration of questionnaires and informal conversations transcribed on a portable wire recorder. Alternate teams were scheduled daily for noon and afternoon observations, or evening interviews (see Table 22).

This sketch of the daily routine implies the centrality which the test administrators and scientific personnel held in the eyes of test subjects. The administrators and scientists decreed, decided, transmitted news, and listened to gripes. At the same time, military supervision was minimal; in accordance with the test plan, the test teams were freed from

Fig. 13.--A physiologist joins a team during the morning march. Shadowed at bottom is the team's trail-breaker. A second team can be seen at extreme left distance.

Fig. 14.--Digging a shelter for lunch while the mail helicopter comes in.

Fig. 15.--Seated in the noon trench completing the hour questionnaire prior to lunch.

Fig. 16.--The author administers the noon hour questionnaire.

Fig. 17.--Tape recording an evening group interview. This was D team, on low rations during the first cycle.

centralized military control and direction as much as possible. The subjects knew that military authority was present to insure the carrying out of the test plan; but, since display of authority was rarely found necessary, the civilian personnel were dominant in subjects' perceptions of "the staff." This tendency was furthered by activities of the social scientists in which they listened to and recorded responses to pictured problems during the daily morning marches and undertook informal group discussions and interviews at night. Once initial hesitancies died away, the subjects began to regard these sessions as opportunity for catharsis and as a channel for transmission of gripes. The social scientists gradually recognized how their measurement activities were interfering with dependence of teams solely on their own resources.

Accordingly, in the second cycle of the experiment, when subjects were making outbound and inbound treks for a second time, morning discussion problems were eliminated from measurement activities and the frequency of evening interviews was reduced to one session per team per experimental phase. This reduction of communication between staff and subjects made teams rely more on their own resources, but it also increased overt hostility to the staff and perhaps weakened subjects' willingness to respond scrupulously to questionnaires. At the time there seemed to be no escape from the quandary of maintaining good relations with subjects and thereby sustaining them, vs. maintaining more distant relations with subjects with the risk that their resentments might be expressed through deliberate invalidation of questionnaire response data.

Throughout the experimental phases, another source of psychological support for subjects was the reassuring presence of the wanigan train. Its movements timed their lives and housed such necessaries as food, medical care, radio communications, and management. It was the one solid object to be seen on the blankness of the horizon. Since its occupants held power, there was fear of it. Since its occupants slept on bunks rather than snow, and ate fresh meat, there was envy of it. Since it was the source of food, news, and power, there was attraction to it--so much so that visits to the wanigan train by subjects had to be sharply curtailed and routinized. Thus, the train formed a central part of the total environment, a part not envisioned in the test planning.

Another thing not planned in the experiment was food stealing. The full-fed teams in the first cycle had full opportunity to observe the discomforts of their peers undergoing less than full rations. They made efforts during the inter-cycle break (control phase, cycle two) to accumulate and conceal spare food.[22]

This had been anticipated, and a thorough inspection before the beginning of the second cycle revealed most of the caches. However, some illegitimate food did get past the inspections, and in addition some food was stolen from supplies on the wanigan during the early days of the second cycle. Thus the subjects undergoing underfeeding in the second cycle presumably

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[22]These food-procuring actions by subjects point up a contrast between the present experiment and previous wartime experiments on hunger. In the earlier experiments the subjects were "high-type" volunteers, (young YMCA careerists in training, or college-type conscientious objectors) upon whom moral responsibility was laid not to eat other than authorized food. Because there is doubt as to the efficacy of this restraint (see Keys et al., 1950, p. 37), this moral burden was not especially emphasized to subjects in the present experiment, and was borne only lightly by them. Instead, reliance was placed on external controls and inspections to limit opportunity to obtain and retain food.

were not as hungry as underfed subjects in the first cycle. The amounts of unauthorized food consumed, and the number of men consuming this food during the second experimental cycle, are subject to little more than conjecture, but subsequent statements by subjects indicate that not more than 5000 calories was shared among the ten persons on low rations during the ten days of the second cycle.

During the first cycle, test teams walked on the north side of the trail. At first they were reluctant to spread apart laterally. After a few days, inter-team hostilities and jealousies rose sufficiently to offset inter-team ties, and teams responded to encouragement (plus better visibility conditions) in enlarging space between them. In the second cycle, both sides of the trail were used, the low-ration teams being assigned to the south side, while full-ration teams remained on the north side. This further increased spatial distance between teams.

One source of friction between teams was that the nearest-the-trail position was regarded as most desirable, while the furthest north (outlying) team was regarded as worst off. A systematic rotation plan for team trail positions was set up, but because it was complicated by controls over adjacent pairings of teams, it was not at first readily comprehended, and some teams jealously regarded others as being unduly favored.

A second source of inter-team friction was a function of the hunger variable, coupled with the requirement that the teams stay approximately abreast during the course of march. The underfed teams, reportedly impelled by a sensitivity to cold while resting and by desire to reach the daily goal and turn in to their sleeping bags, tended to march at a rapid rate in the mornings, and to reduce number and duration of rest periods to a minimum.

This was contrary to instructions given all teams--to maintain a slow, steady pace. The full-fed subjects thus resented being pushed to keep up with underfed teams. In the afternoon the reverse pattern held; underfed teams tired and lagged, so full-fed teams had to delay impatiently for the underfed groups while the latter were resentful at being left lagging behind. Bitterness between teams developed so that the military commander had to intervene and strictly regulate pace and timing of breaks. Ultimately, all teams were required to pace themselves at the rate of the slowest team. This necessary structuring of inter-team relations effectively reduced discord, but it also vitiated the supposed independence of the teams.

Relations between the teams and the staff were shaped by the resources of the staff and its wanigan, and by necessary personal measurements which the staff had to impose on the test subjects. Affect toward the staff also was colored by occasional hostility to those on the staff who for reasons of experimental control had to restrain access to available resources. When exchange between subjects and the social scientists was curtailed in the second cycle, some resentment resulted. Subjects were also naturally somewhat resentful of the relatively good life enjoyed by the staff on the wanigan (especially by those few auxiliary soldiers on the wanigan who had not been selected as test subjects), even though the comforts of wanigan life were minimized to reduce its contrast with the lot of test subjects. The administration of respirator masks to measure ventilation was resisted strongly by subjects[23] and this resistance overflowed into negative affect toward the physiologists seen as being responsible for the masks. The men

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[23]"First they try to work us to death, then they try to freeze us to death, then they try to starve us to death, and now they're trying to smother us!"

were pleased when use of the masks was dropped in the first cycle pending necessary temporary modifications in their design; once the masks functioned properly, as in the second cycle, resistance to them seemed to be less.

At all times, the attitude of subjects toward the experiment was biased by two major considerations. On the positive side, the subjects knew the purpose of the test, saw its importance, and could understand that almost all details and restrictions of the test were rational in terms of the test purpose. Resistance to those details with less rational support in terms of the stated scientific goal (e.g., guard duty at night, or the mythical "third cycle" used to avoid end effect) was high and vehement. On the negative side, subjects knew that their predecessors who had participated in a somewhat similar Quartermaster test on the Greenland Icecap during the previous summer had received no "reward" of rest-and-recuperation (R&R) leave time after completion of the earlier test and return to the United States. It was well advertised by subjects in this earlier test that they had thought they had been promised such leave time as reward for loss of all the summer's weekend passes, arduous duty on the Icecap, etc. Before the 1960 experiment, assurance that men would get R&R leave after the end of the experiment could not be obtained, so that during the experiment any suggestion of this reward for the subjects had to be scrupulously avoided by the staff. Therefore, the only goal of test subjects was a passive one: the ending of present unpleasant duty and return to routine Stateside duty or assignment to other tests.[24]

Another source of resentment by subjects was the relative deprivation of their lot as compared with that of host personnel assigned to the base

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[24]After the 1960 test was completed and subjects returned to the United States, they in fact did receive R&R leave to compensate for their duty in Greenland.

camp (Camp Fistclench) where control phases of the test were spent. The host personnel received a year of overseas credit for a six-month tour of duty in Greenland and also received an overseas supplement to their pay, whereas the Quartermaster personnel were not on overseas status despite the greater severity of their exposure on the Icecap. The one source of extra emolument available to the test subjects was represented in a monetary allowance of about $1.50 a day remaining to them above and beyond charges for rations and quarters while on detached service away from their regular duty stations. This supplement was also received by personnel stationed at the base camp. However, base camp personnel received freshly-prepared meals and slept on cots in warm shelters with solid floors, while test subjects when in the field received somewhat aged canned combat rations which they had to prepare themselves, and they slept on the snow in cold tents. The sting of this contrast was sharpened by the fact that under regulations no increase could be made in the monetary allowance over charges for rations and quarters even when test subjects were receiving only half their due rations during experimental phases of the test. In this context, even such a trivial matter as removal by the staff of the small penny packages of chewing gum from the rations[25] was regarded as a significant deprivation.

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[25]This removal of gum from the rations was required in connection with study of the effects of oral activity (chewing experimental non-caloric gum supplied in lieu of the regular chewing gum) on subjective hunger, to be reported in another place.

APPENDIX B

EXPERIMENTAL DESIGN AND METHODOLOGY

Chapter III included a section summarizing the statistical design and confounding relationships. These require some elaboration, because team factors in the experimental design were confounded with the experimental variables (ration level, task difficulty, and time). In addition, the events and procedural changes taking place during the experiment, which were discussed in Appendix A, must be recapitulated insofar as they confound interpretation of the time variable.

The time variable (t) was broken into four experimental phases of five days each, in each of which the men were marching under experimental conditions of ration and task. The first two phases formed the first cycle, followed by a rest period and then by the second two experimental phases of the second cycle. Data from the second cycle are to be contrasted (t_1) in the analysis with data from the first cycle, because in the second cycle (a) the men were more acclimated and experienced; (b) the weather and snow conditions were more benign; (c) there was less sympathetic interaction with investigators due to the cutting down of the interviewing schedule; (d) teams were more spread out because both sides of the trail were used for marching; (e) the wearing of respirator masks was more continuous, due to elimination of "bugs" in mask functioning; (f) a small amount of contraband food was successfully consumed by at least one of the low-ration teams (this appeared to have considerable psychologic if not physiologic value to team members);

and (g), there was a switching of team memberships. Nor can this list of differences between the two cycles be considered complete; quite possibly other differences also occurred which were not noted by the observers.

A second contrast (t_2) in the time variable is that between the first _vs._ second phases within each of the two cycles. The first five-day experimental phase each cycle was a march toward the Greenland coast, during which the elevation declined at roughly about ten feet in a mile. The second phases in each cycle were "uphill" not only because of this slight grade but also because the subjects were facing the prevailing wind on the return leg. In addition, of course, the subjects in the second phases of the cycles were affected by having already undergone five days of relative hardship and by looking forward to the end of the march.

A third possible contrast (t_1t_2) in the time variable is that between the first and fourth phases _vs._ the second and third; in the first and fourth phases the subjects were exposed to "beginning" and "end" effects in the experiments, while no such special characteristics marked the second and third marching phases.

Like the other variables (ration level, task difficulty), time variable contrasts are partly confounded with group-composition variables, as is succinctly expressed in the confounding relationships (see Chapter III). In this experiment, some teams were subjected to certain conditions (of ration and task) while other teams were at the same time under other conditions. Thus effects of differences between experimental conditions are confounded with differences between teams. This confounding was somewhat offset by rotating teams through each of the combinations of experimental conditions during different time phases. Even so, the effect of different conditions remains confounded with idiosyncratic differences between teams, as these might change over time due to their different previous experiences with different experimental conditions.

To make the teams less unique, less idiosyncratic, their membership composition was changed between cycles. Thus some small increase in generalizability of results was obtained at cost of introduction of another variable, namely, switching of team memberships. The experimental design implies a conception of the effects of partially different memberships in teams at different times as affecting the <u>entire</u> memberships of teams. That is, for example, the change of follower subgroups taking place at the beginning of the second cycle was presumed to have the effect of changing <u>all</u> members of the modified teams, not merely changing the team averages of leader and follower subgroup attributes. Conceptually, the leader and follower subgroup attributes of teams were regarded as treatments which were undergone by all five members of hypothetically "neutral" teams. Just as all five members jointly underwent varying ration inputs or task requirements, so too they jointly underwent varying "leader personalities" and "follower personalities." That this conceptualization is realistic may be understood when one considers that a new leader and his aid, coming into an organization or group, do not merely add their (probably new) opinions to those of follower members, so that the average of group opinion changes; rather, the new leader subgroup is apt to <u>change</u> the opinions of followers to be more congruent with leader subgroup opinion. In this sense, new leadership or new followership is a treatment which commonly affects all members of a group instead of merely contributing to the aggregate of group membership characteristics.

As shown on the schematic diagram in Chapter III, subjects were broken into subgroups of leaders and followers. One man was dropped from each of the proposed six-man teams at the beginning of the experiment; this man was deleted from the leader subgroups, so leader subgroups consisted of two rather than three men. The four leader subgroups could conceptually be combined with the four follower subgroups in sixteen different ways, but in the experiment, only eight of these combinations were used. Leader subgroups a' and b' were never combined with follower subgroups c" and d", and leader subgroups c' and d' were never combined with follower subgroups a" and b". This is what is meant by the confounding equation $I \equiv S_1G_1$ stated in Chapter III.

The set of ten men in subgroups c', d', c", and d" underwent the low ration treatment in the first cycle of the experiment and the high ration treatment in the second cycle; the other ten men followed a reverse pattern. This means that average effects of low <u>vs.</u> high rations on the data are confounded with (i.e., confused with) the possibility that the two ten-man sets may have changed in the second cycle due to their different experiences in the first cycle. Even if the two ten-man sets had equivalent average characteristics to begin with, being on different ration levels in the first cycle might have changed them so that the two sets were different at the start of the second cycle. If this were so (as is likely), the two ten-man sets beginning the second cycle would react differently to the different ration levels than did the two sets in the first cycle. This is what is meant by the confounding relationship $I \equiv S_1t_1R$ or G_1t_1R.

The S_1 contrast, as stated in Chapter III, refers to the contrast between the first two leader subgroups (a' and b') <u>vs.</u> the second two (c' and d'). In Appendix A the characteristics of assigned leaders were discussed, and it was pointed out that leaders in the first two teams had previous Arctic experience while leaders of the other two teams did not. Therefore, the S_1 variable can be termed "leader experience." It was also pointed out in the discussion of team allocations that the first and third leader subgroups (a' and c') included leaders appointed before arrival in Greenland, who accordingly had more legitimate formal sanction than did the privates elevated to acting NCO leadership in leader subgroups b' and d' after physical disabilities forced replacement of two of the legitimate NCO's. The S_2 contrast, referring to differences between the first and third <u>vs</u>. second and fourth leader subgroups, can therefore be called the "leader legitimation" variable. The third possible contrast between leaders, termed S_1S_2, refers to possible differences between the first (a') and fourth (d') leader subgroups <u>vs</u>. the second (b') and third (c'). Observer comments suggest that this contrast relates to leadership styles: the first and fourth leaders were more task-oriented, the second and third were more permissive and person-oriented.

The analagous contrasts G_1, G_2, and G_1G_2 between various pairings among the four follower subgroups are less clear-cut in possible meaning. The first two follower subgroups (a" and b") included more "popular" subjects; they also included no members with previous Arctic experience, whereas the second two (c" and d") did. This is the G_1 contrast. However, referral to Table 20 in Appendix A shows no clear differences by which the other two contrasts between pairs of follower subgroups can be defined.

A word is required on the meaning and interpretation of the various interactions between the S (leader) variables and the G (follower) variables. It will be remembered that each of these two sets of contrasts is presumed to represent influences acting on all members of a team, rather than representing attributes merely of a subgroup within a team. The S_2 contrast, which can be related to leader legitimation, thus is a contrast between ten persons who may regard themselves (or be regarded) as "legitimate" because their two team leaders are legitimate, vs. the ten persons in the other two teams lacking legitimate leaders. Effects of this S_2 (legitimation) variable may however vary with the nature of followership in teams, as for instance whether followers include members with Arctic experience or not (i.e., the G_1 variable). The S_2G_1 interaction would accordingly refer to the possibility that the effects of legitimate leadership in teams vary with the experience of followers in teams. Other interactions, such as the $S_1S_2G_1$ (task- vs. person-oriented leadership x follower experience) interaction, can be interpreted similarly.

On the following page a dummy analysis-of-variance table is shown which lists the main variables of the experiment (task difficulty, ration level, and time) and their interactions. In parentheses following each variable are the more important (lower order) confoundings for each. In reviewing analyses in Chapter IV, it will be important for the reader to remember that each confounding of a given experimental variable or interaction of variables forms an alternative explanation for significant effects attributed to that variable or interaction in the text. Only good judgment can help in deciding which among a set of confounded variables is the "true" cause of an observed effect. For instance, if hunger ratings of subjects are higher under the low-ration treatment than under the high-ration treatment, this effect may be attributed to the effects of ration levels or to the variables confounded with the ration variable: namely, S_1t_1 (meaning possible changes in the effects of leadership experience in the Arctic over successive test cycles), or G_1t_1, or $S_1S_2G_2$, etc. However, our common sense

TABLE 21

LOWER-ORDER CONFOUNDINGS OF BASIC VARIABLES INCLUDED IN THE TYPICAL ANALYSIS OF VARIANCE TABLES

Source of Variation	d. f.	Confoundings
Cycles (t_1)	1	$I \equiv S_2G_2 \equiv S_1R \equiv G_2t_2T \equiv S_1S_2G_1G_2$, etc.
Phases (t_2)	1	$I \equiv S_2T \equiv S_2G_2t_1t_2 \equiv G_2t_1T \equiv S_1t_1t_2R$, etc.
Tasks (T)	1	$I \equiv S_2t_2 \equiv G_2t_1t_2$, etc.
Rations (R)	1	$I \equiv S_1t_1 \equiv G_1t_1 \equiv S_1S_2G_2 \equiv G_1G_2S_2$, etc.
t_1t_2	1	$I \equiv G_2T \equiv G_1t_2R \equiv S_2G_2t_2$, etc.
t_1T	1	$I \equiv G_2t_2 \equiv S_2G_2T \equiv S_1RT \equiv S_2t_1t_2$, etc.
t_1R[a]	1	$I \equiv S_1 \equiv G_1 \equiv S_1S_2G_2t_1 \equiv G_1S_2G_2t_1$, etc.
t_2T[a]	1	$I \equiv S_2 \equiv G_2t_1 \equiv S_1S_2G_1$, etc.
t_2R	1	$I \equiv S_1G_2T \equiv G_1t_1t_2 \equiv S_2TR$, etc.
TR	1	$I \equiv G_1G_2t_2 \equiv G_1t_1T \equiv S_1t_1T \equiv S_2t_2R$, etc.
t_1t_2T[a]	1	$I \equiv G_2 \equiv S_2t_1$, etc.
t_1t_2R[b]	1	$I \equiv G_1t_2 \equiv S_1t_2$, etc.
t_1TR[b]	1	$I \equiv S_1T \equiv G_1T \equiv S_1S_2t_2 \equiv G_1S_2t_2$, etc.
t_2TR[a]	1	$I \equiv S_2R \equiv S_1G_2 \equiv G_2t_1R \equiv G_1G_2 \equiv S_1S_2t_1$, etc.
T_1t_2TR[a]	1	$I \equiv S_1S_2 \equiv G_1S_2 \equiv G_2R \equiv G_1G_2t_1$, etc.
Residual	64	. . . .

[a]These interactions and effects are wholely confounded with the more likely lower-order effects of inter-group differences.

[b]These two three-factor interactions almost never produced statistically-reliable effects on the data.

sense would here attribute the variation in hunger ratings to the independent ration-level variable, rather than to team leadership and followership interaction effects confounded with the ration variable.

About the higher order interaction effects shown in Table 21 and the likelihood of their being found statistically significant, there is a saying: "Nature would not be so unkind!" That is, higher order interactions among disparate variables are rarely found to be significant. This is just as well, because they are often very difficult to conceptualize and interpret. When such higher-order interactions as t_1t_2RT, t_2RT, etc. are found significant in the analyses of variance appearing later in this chapter, an explanation may be sought from among the simpler sources of variance with which these high-order interactions are confounded. For example, the S_1S_2 effect has been described as relating to leadership style--the first and fourth leaders appeared more task-oriented than the second and third. S_1S_2 is confounded with t_1t_2TR; when the latter is reported in analysis of variance tables as significant, it can perhaps best be explained by reference to the leadership-style variable. Much the same can be said about the confounding of S_1 and G_1 with t_1R, the confounding of S_2 with t_2T, the confounding of G_2 with t_1t_2T, and the confounding of S_1G_2 with t_2TR. In each of these cases, interactions of the main independent variables (ration, task, and time) are better explained by reference to the differences in personal attributes and combinations of personal attributes of teams of test subjects with which these interactions are confounded. Thus, too, the fact brought out earlier in this section, that the change in test cycles was characterized by a switching of team memberships, is the gist of the confounding relationships reading $t_1 \equiv S_2G_2$ and $R \equiv S_1S_2G_2 \equiv G_1G_2S_2$. In sum, there is no getting away from the fact that results of this experiment are conditioned by whatever were the main effects and interactions among unique characteristics of the social units formed by combination and recombination of test subjects into teams at different times.

An example of the preceding is found in Table 24, showing a decrease in reported hunger in the second cycle which is statistically reliable at the .01 probability level. Related to this decrease are the t_1t_2T and t_2TR interactions which are significant at the .10 and .05 levels respectively. These reflect the failure of one team to register any increase in hunger when undergoing low rations in the second cycle. This team was unquestionably more hungry under low rations, even though they gained access to a limited amount of unauthorized food. However, subjects in this team were influenced by one individual who was hostile to participation in the test and who urged his fellows to cripple the experiment by responding misleadingly to questionnaire items. One of his co-members joined him in reporting little or no hunger under low rations and this probable misrepresentation caused the distortion in average reported hunger for this team.

Questionable responses, such as these, have not been "corrected" or edited out of the data.[26] Such procedure would generally require more firm criteria for acceptance or rejection of responses than are available on the basis of present knowledge about subjective and social effects of underfeeding. However, these deviate response data have contributed to error

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[26]Among the several score of variables for which response data were treated by analysis of variance were a few characterized by a small (< 1%) amount of omissions. To simplify computation by retention of constant numbers of observations within cells (teams), missing data were estimated by averaging other responses within the cell and rounding to the nearest integer. In no instance was more than one response missing within a cell.

variance and weakened the power of the statistical tests.[27] Further, when deviate responses are centered among one or two teams during one or two of the test phases, these responses contributed to deviate team averages so that inter-team contrasts are likely to be found statistically significant. Certain of these inter-team contrasts are entirely confounded with interaction effects of the independent variables in the design. Accordingly, these confounded interactions are especially suspect. As noted earlier, they include: t_1R, t_2T, t_1t_2T, t_2TR, and t_1t_2TR.

Most evidences reported later in the chapter on results derive from self-reports by subjects. Qualifications must be stipulated regarding the meaningfulness of this evidence. First, the questions were posed by written questionnaires (reproduced in Appendix D). So presented, they were open to unique interpretation by individual subjects. During the extended pretest briefing, explanation of the meaning of the questions on the "pre-questionnaire" was made one-by-one; this was also done when subjects were introduced to other questionnaires later. However, this does not bar the possibility that some subjects persisted in some misconstructions of questions or changed their interpretation of question meanings with the passing of time.

Many of the questions were to be answered with reference to a common scale, termed the "levels" scale. Use of a common scale for questions covering many dimensions is not recommended by Guilford (1954, p. 293). However, since this Greenland research was often concerned with such molar dimensions as like-dislike, agree-disagree, or subjective intensity, use of a single general scale representing levels on these dimensions seemed not unreasonable.

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[27]The mean intra-cell error variance of responses to fifteen unsystematically selected questions was 2.1613, which is higher than typically expected for seven-point scale data relating to well-structured psychological dimensions.

Adoption of a single scale in any case seemed advisable in order to simplify the conceptual tasks of subjects when answering questions in a stressful situation. Another minor advantage to the use of a single scale for many question items was reduction in the mere volume of paper that subjects had to handle while sitting out on the Icecap.

This single scale included seven ordered statements referring to the level at which a given dimension was perceived by subjects to be present in a situation or object. The scale was bi-polar in that levels were described in terms of "high" or "low" with adverbial modifications. Modifiers were selected from among those scaled by Cliff (1959) so as to approximate equal-appearing intervals. As has been pointed out by Anderson (1961), however, an assumption of interval data is not prerequisite to application of parametric methods. The derived scale has not been validated for normality, homoscedasticity, etc. of within-treatment distributions for each of the many personal and social dimensions studied under the several experimental conditions. The analysis of variance technique used to analyze these distributions is relatively insensitive to most deviations from assumptions underlying the technique, especially when equally-sized n's greater than 15 are used in statistical comparisons (Boneau, 1960).

The scope of data obtained was extensive, relating to three separate disciplines: physiology, psychology, and sociology. While there were clear justifications for the intensity of planned measurement activities, there was also danger that subjects would become "test happy." A representative sample of questionnaire administrations during a four-day period is shown in Table 22. The frequency of contact with test teams is slightly greater than originally planned, due to the cutback in duration of test phases from

TABLE 22

SCHEDULE OF APPLICATION OF QUESTIONNAIRES AND CONDUCT OF INTERVIEWS BY OBSERVERS DURING CYCLE II, FIRST PHASE

Date	Teams							
	A'		B'		C'		D'	
	Noon	Evening	Noon	Evening	Noon	Evening	Noon	Evening
Fri. 12 Aug.	. .	. .	. .	. .	. .	. .	. .	. .
Sat. 13 Aug.	. .	. .	Qu. A (Dick)	Interview & Qu. C (John)	. .	. .	Qu. A (John)	Interview & Qu. C (Dick)
Sun. 14 Aug.	Qu. A (Dick)	Interview & Qu. B (John)	. .	. .	Qu. A (John)	Interview & Qu. B (Dick)	. .	. .
Mon. 15 Aug.	. .	. .	. .	Food Qu. & Qu. B (Dick)	. .	. .	. .	Food Qu. & Qu. B (John)
Tues. 16 Aug.	. .	Food Qu. & Qu. B (Dick)	. .	. .	. .	Food Qu. & Qu. B (John)	. .	. .

seven days to five. A further difficulty inherent in the data-gathering method used was that the content of questions probably influenced subjects' perceptions of their own situations. The fact that certain characteristics were asked about implied that their presence was likely and possibly important. This focusing of subjects' attentions on certain aspects of their situation may well have changed their behaviors and their perceptions of others' behaviors, with consequent effect on the nature of social relationships which evolved and which were reported.

Not all questionnaire items were pre-tested in a situation comparable to those the subjects underwent during the experiment.[28] Accordingly, a number of faulty items were included in the questionnaire. For example, item 5 on Questionnaire C asked for sociometric nominations of good leaders for future Arctic tests; some subjects commented that the only people they could honestly nominate were their own worst enemies.[29] Question 1-B on Questionnaire C asked for subjects' estimates of their co-workers annoyance and irritation with a list of items; this level of abstraction ("what I imagine they think") was difficult for the test soldiers to attain while undergoing the physical stresses of the cross-Icecap marches, so the item was skipped. A third question (item 7, Questionnaire C) asked subjects to rate co-workers in terms of "knowing them" (being well-informed about them). However, in the enforced intimacies of marching across the Icecap and sleeping in a small tent, members came to feel that they knew each other altogether too well, so the question had little reality to them. These same circumstances

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[28]On the other hand, many of the items used were derived from successful questions used in previous research on small groups in the Arctic.

[29]A standard joke was, "If you don't watch out, I'll nominate you as a good leader for next year's test on the Icecap."

also contributed to some subjects' resistance to having to make peer nominations to certain group roles (e.g., "real leader," "complainer," etc.--see item 9, Questionnaire C). This nomination task required a sort of detachment and independence from the group which was somewhat unrealistic in test conditions requiring heavy interdependence among team members and a necessity for each member to fill many roles.[30]

A final consideration in interpretation of the meaningfulness of the questionnaire response data is that items appearing on the same questionnaire cannot be presumed to be independent of each other or of the immediate circumstances in which the responses were given. A subject on a cold, miserable day might rate all his stresses more extremely despite their irrelevance to the weather. This can be termed a "halo" effect. It was not possible to apply given questionnaires to all teams on a single day, so inter-team differences (which are confounded with inter-treatment differences) may partly be attributable to time differences in questionnaire administration within a test phase. The partial replication of certain questions reworded on the different questionnaires of course helped to reduce dependence of observations on a single set of test circumstances.

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[30]For a discussion of the difficulties which may be encountered in extension of the test devices and measures commonly used in the university psychological laboratory to social-psychological research among military units in Polar regions, see Zimmer (1958).

APPENDIX C

TABLES

The reader is referred to Appendix B for explanation of the analyis of variance tables. In particular, this report is limited to discussion of the following eight experimental effects:

Cycles main effect (t_1)

Phases main effect (t_2)

Task main effect (T)

Ration main effect (R)

Cycle-Phase interaction (t_1t_2)

Cycle-Task interaction (t_1T)

Phase-Ration interaction (t_2R)

Task-Ration interaction (TR)

Of the remaining seven interactions appearing on the analysis of variance tables, five are wholely confounded with inter-group differences and two others (t_1t_2R and t_1TR) rarely show any effects statistically reliable at the .10 level.

TABLE 23

LEVEL OF ANNOYANCE AND IRRITATION WITH THE WEATHER IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-1)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	17.1125	6.79	.05
Phases (t_2)	1	0.1125	<1	. .
Tasks (T)	1	1.5125	<1	. .
Rations (R)	1	2.1125	<1	. .
t_1t_2	1	0.1125	<1	. .
t_1T	1	5.5125	2.19	. .
t_1R	1	0.6125	<1	. .
t_2T	1	1.5125	<1	. .
t_2R	1	0.3125	<1	. .
TR	1	0.0125	<1	. .
t_1t_2T	1	0.6125	<1	. .
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	0.0125	<1	. .
t_2TR	1	4.5125	1.79	. .
t_1t_2TR	1	3.6125	1.43	. .
Residual	64	2.5188	. .	. .

TABLE 23--Continued

Mean Values

A. Cycle by Phase

	Phase 1	Phase 2	Avg.
Cycle I	4.40	4.55	4.48
Cycle II	3.55	3.55	3.55
Avg.	3.98	4.05	4.01

B. Cycle by Task

	Task sled	Task back
Cycle I	4.60	4.35
Cycle II	3.15	3.95
Avg.	3.88	4.15

C. Cycle by Ration

	Ration High	Ration Low
Cycle I	4.40	4.55
Cycle II	3.30	3.80
Avg.	3.85	4.18

D. Phase by Task

	Task sled	Task back
Phase 1	3.70	4.25
Phase 2	4.05	4.05

E. Phase by Ration

	Ration High	Ration Low
Phase 1	3.75	4.20
Phase 2	3.95	4.15

F. Ration by Task

	Task sled	Task back
Ration High	3.70	4.00
Ration Low	4.05	4.30

G. Cycle by Phase by Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.30	4.50
	Phase 2	4.50	4.60
II	Phase 1	3.20	3.90
	Phase 2	3.40	3.70

H. Cycle by Phase by Task

Cycle		Task sled	Task back
I	Phase 1	4.30	4.50
	Phase 2	4.90	4.20
II	Phase 1	3.10	4.00
	Phase 2	3.20	3.90

I. Cycle by Task by Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.50	4.70
	back	4.30	4.40
II	sled	2.90	3.40
	back	3.70	4.20

J. Phase by Ration by Task

Phase	Ration	Task sled	Task back
1	High	3.70	3.80
	Low	3.70	4.70
2	High	3.70	4.20
	Low	4.40	3.90

K. Cycle by Phase by Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	4.40	4.40	4.60
	Phase 2	4.80	4.20	5.00	4.20
II	Phase 1	3.20	3.20	3.00	4.80
	Phase 2	2.60	4.20	3.80	3.60

TABLE 24

LEVEL OF BEING AFFECTED BY HUNGER IN THE PAST FEW DAYS
(QUESTIONNAIRE B, ITEM 6-4)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	16.2000	8.50	.01
Phases (t_2)	1	0.8000	<1	. .
Tasks (T)	1	0.4500	<1	. .
Rations (R)	1	68.4500	35.91	.001
t_1t_2	1	0.0500	<1	. .
t_1T	1	0.2000	<1	. .
t_1R	1	3.2000	1.68	. .
t_2T	1	0.2000	<1	. .
t_2R	1	1.8000	<1	. .
TR	1	1.2500	<1	. .
t_1t_2T	1	6.0500	3.17	.10
t_1t_2R	1	0.4500	<1	. .
t_1TR	1	0.2000	<1	. .
t_2TR	1	9.8000	5.14	.05
t_1t_2TR	1	0.4500	<1	. .
Residual	64	1.9062	. .	. .

TABLE 24--Continued

Mean Values

A. Cycle by Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.50	5.75	5.62
II	4.65	4.80	4.72
Avg.	5.08	5.28	5.18

B. Cycle by Task

Cycle	sled	back
I	5.65	5.60
II	4.85	4.60
Avg.	5.25	5.10

C. Cycle by Ration

Cycle	High	Low
I	4.90	6.35
II	3.60	5.85
Avg.	4.28	5.92

D. Phase by Task

Phase	sled	back
1	5.10	5.05
2	5.40	5.15

E. Phase by Ration

Phase	High	Low
1	4.30	5.85
2	4.20	6.10

F. Ration by Task

Ration	sled	back
High	4.45	4.05
Low	6.05	6.15

G. Cycle by Phase by Ration

Cycle		Ration High	Ration Low
I	Phase 1	5.00	6.00
	Phase 2	4.80	6.70
II	Phase 1	3.60	5.70
	Phase 2	3.60	6.00

H. Cycle by Phase by Task

Cycle		Task sled	Task back
I	Phase 1	5.20	5.80
	Phase 2	6.10	5.40
II	Phase 1	5.00	4.30
	Phase 2	4.70	4.90

I. Cycle by Task by Ration

Cycle	Task	Ration High	Ration Low
I	sled	5.10	6.20
	back	4.70	6.40
II	sled	3.80	5.90
	back	3.40	5.80

J. Phase by Ration by Task

Phase	Ration	Task sled	Task back
1	High	4.10	4.50
	Low	6.10	5.60
2	High	4.80	3.60
	Low	6.00	6.70

K. Cycle by Phase by Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.60	5.40	5.80	6.20
	Phase 2	5.60	4.00	6.60	6.80
II	Phase 1	3.60	3.60	6.40	5.00
	Phase 2	4.00	3.20	5.40	6.60

TABLE 25

LEVEL OF ANNOYANCE AND IRRITATION WITH HUNGER IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-8)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.4500	<1	. .
Phases (t_2)	1	5.0000	4.06	.05
Tasks (T)	1	0.4500	<1	. .
Rations (R)	1	61.2500	49.75	.001
t_1t_2	1	0.0000	<1	. .
t_1T	1	1.2500	1.02	. .
t_1R	1	6.0500	4.91	.05
t_2T	1	9.8000	7.96	.01
t_2R	1	0.8000	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	0.2000	<1	. .
t_1t_2R	1	0.2000	<1	. .
t_1TR	1	0.4500	<1	. .
t_2TR	1	0.8000	<1	. .
t_1t_2TR	1	0.0000	<1	. .
Residual	64	1.2312	. .	. .

TABLE 25—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	4.85	5.35	5.10
II	4.70	5.20	4.95
Avg.	4.78	5.28	5.02

B. Task

Cycle	sled	back
I	5.05	5.15
II	5.15	4.75
Avg.	5.10	4.95

C. Ration

Cycle	High	Low
I	4.50	5.70
II	3.80	6.10
Avg.	4.15	5.90

D. Task

Phase	sled	back
1	4.50	5.05
2	5.70	4.85

E. Ration

Phase	High	Low
1	4.00	5.55
2	4.30	6.25

F. Task

Ration	sled	back
High	4.30	4.00
Low	5.90	5.90

G. Ration

Cycle		High	Low
I	Phase 1	4.40	5.30
	Phase 2	4.60	6.10
II	Phase 1	3.60	5.80
	Phase 2	4.00	6.40

H. Task

Cycle		sled	back
I	Phase 1	4.40	5.30
	Phase 2	5.70	5.00
II	Phase 1	4.60	4.80
	Phase 2	5.70	4.70

I. Ration

Cycle	Task	High	Low
I	sled	4.60	5.50
	back	4.40	5.90
II	sled	4.00	6.30
	back	3.60	5.90

J. Task

Phase	Ration	sled	back
1	High	3.70	4.30
	Low	5.30	5.80
2	High	4.90	3.70
	Low	6.50	6.00

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.00	4.80	4.80	5.80
	Phase 2	5.20	4.00	6.20	6.00
II	Phase 1	3.40	3.80	5.80	5.80
	Phase 2	4.60	3.40	6.80	6.00

TABLE 26

LEVEL OF HUNGRINESS TODAY
(QUESTIONNAIRE C, ITEM 15-2)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.1125	1.58	. .
Phases (t_2)	1	4.5125	3.37	.10
Tasks (T)	1	1.0125	< 1	. .
Rations (R)	1	46.5125	34.78	.001
t_1t_2	1	1.5125	1.13	. .
t_1T	1	1.0125	< 1	. .
t_1R	1	5.5125	4.12	.05
t_2T	1	4.5125	3.37	.10
t_2R	1	2.1125	1.58	. .
TR	1	0.1125	< 1	. .
t_1t_2T	1	1.5125	1.13	. .
t_1t_2R	1	1.5125	1.13	. .
t_1TR	1	0.1125	< 1	. .
t_2TR	1	0.0125	< 1	. .
t_1t_2TR	1	0.0125	< 1	. .
Residual	64	1.3375	. .	. .

TABLE 26—Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	5.50	5.70	5.60
	II	4.90	5.65	5.27
	Avg	5.20	5.68	5.44

B. Task

		sled	back
Cycle	I	5.60	5.60
	II	5.05	5.50
	Avg	5.32	5.55

C. Ration

		High	Low
Cycle	I	5.10	6.10
	II	4.25	6.30
	Avg	4.68	6.20

D. Task

		sled	back
Phase	1	4.85	5.55
	2	5.80	5.55

E. Ration

		High	Low
Phase	1	4.60	5.80
	2	4.75	6.60

F. Task

		sled	back
Ration	High	4.60	4.75
	Low	6.05	6.35

G. Ration

			High	Low
Cycle	I	Phase 1	5.30	5.70
		Phase 2	4.90	6.50
	II	Phase 1	3.90	5.90
		Phase 2	4.60	6.70

H. Task

			sled	back
Cycle	I	Phase 1	5.40	5.60
		Phase 2	5.80	5.60
	II	Phase 1	4.30	5.50
		Phase 2	5.80	5.50

I. Ration

		Task	High	Low
Cycle	I	sled	5.10	6.10
		back	5.10	6.10
	II	sled	4.10	6.00
		back	4.40	6.60

J. Task

		Ration	sled	back
Phase	1	High	4.30	4.90
		Low	5.40	6.20
	2	High	4.90	4.60
		Low	6.70	6.50

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	5.20	5.40	5.60	5.80
		Phase 2	5.00	4.80	6.60	6.40
	II	Phase 1	3.40	4.40	5.20	6.60
		Phase 2	4.80	4.40	6.80	6.60

TABLE 27

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY HUNGER
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-4)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.4500	1.67	. .
Phases (t_2)	1	0.4500	<1	. .
Tasks (T)	1	0.0500	<1	. .
Rations (R)	1	51.2000	34.86	.001
t_1t_2	1	8.4500	5.75	.05
t_1T	1	4.0500	2.76	. .
t_1R	1	0.2000	<1	. .
t_2T	1	0.0500	<1	. .
t_2R	1	0.8000	<1	. .
TR	1	0.0000	<1	. .
t_1t_2T	1	0.0500	<1	. .
t_1t_2R	1	0.0000	<1	. .
t_1TR	1	0.8000	<1	. .
t_2TR	1	0.8000	<1	. .
t_1t_2TR	1	0.2000	<1	. .
Residual	64	1.4688	. .	. .

TABLE 27—Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	5.35	5.85	5.60
II	5.65	4.85	5.25
Avg.	5.50	5.35	5.42

B.

Cycle	Task sled	Task back
I	5.85	5.35
II	5.05	5.45
Avg.	5.45	5.40

C.

Cycle	Ration High	Ration Low
I	4.85	6.35
II	4.40	6.10
Avg.	4.62	6.22

D.

Phase	Task sled	Task back
1	5.50	5.50
2	5.40	5.30

E.

Phase	Ration High	Ration Low
1	4.60	6.40
2	4.65	6.05

F.

Ration	Task sled	Task back
High	4.65	4.60
Low	6.25	6.20

G.

Cycle		Ration High	Ration Low
I	Phase 1	4.50	6.20
	Phase 2	5.20	6.50
II	Phase 1	4.70	6.60
	Phase 2	4.10	5.70

H.

Cycle		Task sled	Task back
I	Phase 1	5.60	5.10
	Phase 2	6.10	5.60
II	Phase 1	5.40	5.90
	Phase 2	4.70	5.00

I.

Cycle	Task	Ration High	Ration Low
I	sled	5.20	6.50
	back	4.50	6.20
II	sled	4.10	6.00
	back	4.70	6.20

J.

Phase	Ration	Task sled	Task back
1	High	4.50	4.70
	Low	6.50	6.30
2	High	4.80	4.50
	Low	6.00	6.10

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	4.80	4.20	6.40	6.00
	Phase 2	5.60	4.80	6.60	6.40
II	Phase 1	4.20	5.20	6.60	6.60
	Phase 2	4.00	4.20	5.60	5.80

TABLE 28

PREFERENCE RATINGS OF NINE MISCELLANEOUS CANNED RATION ITEMS
(FOOD QUESTIONNAIRE, ITEM 1)

Analysis of Variance				
Source of Variation	**d. f.**	**Mean Square**	**F**	**Significance Level**
Cycles (t_1)	1	1.5961	1.52	. .
Phases (t_2)	1	0.3781	<1	. .
Tasks (T)	1	1.4311	1.36	. .
Rations (R)	1	4.1861	3.98	.10
t_1t_2	1	0.1201	<1	. .
t_1T	1	0.9461	<1	. .
t_1R	1	0.0061	<1	. .
t_2T	1	0.0001	<1	. .
t_2R	1	1.3261	1.26	. .
TR	1	0.0551	<1	. .
t_1t_2T	1	2.7011	2.57	. .
t_1t_2R	1	0.0361	<1	. .
t_1TR	1	0.2101	<1	. .
t_2TR	1	2.8501	2.71	. .
t_1t_2TR	1	1.6531	1.57	. .
Residual	64	1.0519	. .	. .

TABLE 28--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	6.80	7.02	6.91
II	7.16	7.22	7.19
Avg.	6.98	7.12	7.05

B. Task

Cycle	sled	back
I	6.66	7.15
II	7.16	7.22
Avg.	6.92	7.18

C. Ration

Cycle	High	Low
I	6.67	7.14
II	6.97	7.41
Avg.	6.82	7.28

D. Task

Phase	sled	back
1	6.84	7.12
2	6.98	7.25

E. Ration

Phase	High	Low
1	6.88	7.08
2	6.76	7.48

F. Task

Ration	sled	back
High	6.66	6.98
Low	7.17	7.38

G. Ration

Cycle		High	Low
I	Phase 1	6.67	6.93
	Phase 2	6.67	7.36
II	Phase 1	7.09	7.23
	Phase 2	6.85	7.59

H. Task

Cycle		sled	back
I	Phase 1	6.74	6.86
	Phase 2	6.59	7.44
II	Phase 1	6.95	7.37
	Phase 2	7.38	7.06

I. Ration

Cycle	Task	High	Low
I	sled	6.35	6.98
	back	6.99	7.31
II	sled	6.97	7.36
	back	6.97	7.46

J. Task

Phase	Ration	sled	back
1	High	6.53	7.23
	Low	7.16	7.00
2	High	6.79	6.73
	Low	7.18	7.77

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	6.20	7.14	7.28	6.58
	Phase 2	6.50	6.84	6.68	8.04
II	Phase 1	6.86	7.32	7.04	7.42
	Phase 2	7.08	6.62	7.68	7.50

TABLE 29

LEVEL OF BEING AFFECTED BY SEX IN THE PAST FEW DAYS
(QUESTIONNAIRE B, ITEM 6-1)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.2000	<1	. .
Phases (t_2)	1	0.2000	<1	. .
Tasks (T)	1	0.2000	<1	. .
Rations (R)	1	0.8000	<1	. .
t_1t_2	1	0.4500	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	0.0500	<1	. .
t_2T	1	0.0500	<1	. .
t_2R	1	1.2500	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	9.8000	4.34	.05
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.0000	<1	. .
t_2TR	1	39.2000	17.37	.001
t_1t_2TR	1	4.0500	1.80	. .
Residual	64	2.2562	. .	. .

TABLE 29--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	5.30	5.25	5.28
II	5.05	5.30	5.18
Avg.	5.18	5.28	5.22

B. Task

Cycle	sled	back
I	5.25	5.30
II	5.10	5.25
Avg.	5.18	5.28

C. Ration

Cycle	High	Low
I	5.40	5.15
II	5.25	5.10
Avg.	5.32	5.12

D. Task

Phase	sled	back
1	5.10	5.25
2	5.25	5.30

E. Ration

Phase	High	Low
1	5.15	5.20
2	5.50	5.05

F. Task

Ration	sled	back
High	5.20	5.45
Low	5.15	5.10

G. Ration

Cycle		High	Low
I	Phase 1	5.20	5.40
	Phase 2	5.60	4.90
II	Phase 1	5.10	5.00
	Phase 2	5.40	5.20

H. Task

Cycle		sled	back
I	Phase 1	4.90	5.70
	Phase 2	5.60	4.90
II	Phase 1	5.30	4.80
	Phase 2	4.90	5.70

I. Ration

Cycle	Task	High	Low
I	sled	5.30	5.20
	back	5.50	5.10
II	sled	5.10	5.10
	back	5.40	5.10

J. Task

Phase	Ration	sled	back
1	High	4.30	6.00
	Low	5.90	4.50
2	High	6.10	4.90
	Low	4.40	5.70

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.80	6.60	6.00	4.80
	Phase 2	6.80	4.40	4.40	5.40
II	Phase 1	4.80	5.40	5.80	4.20
	Phase 2	5.40	5.40	4.40	6.00

TABLE 30

LEVEL OF ANNOYANCE AND IRRITATION WITH SEX IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-5)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	7.2000	2.19	. .
Phases (t_2)	1	0.0000	<1	. .
Tasks (T)	1	0.0500	<1	. .
Rations (R)	1	0.0000	<1	. .
t_1t_2	1	0.2000	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	1.8000	<1	. .
t_2T	1	0.0500	<1	. .
t_2R	1	1.8000	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	4.0500	1.23	. .
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.0500	<1	. .
t_2TR	1	36.4500	11.07	.001
t_1t_2TR	1	2.4500	<1	. .
Residual	64	3.2938	. .	. .

TABLE 30—Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	5.50	5.40	5.45
	II	4.80	4.90	4.85
	Avg.	5.15	5.15	5.15

B. Task

		sled	back
Cycle	I	5.50	5.40
	II	4.85	4.85
	Avg.	5.18	5.12

C. Ration

		High	Low
Cycle	I	5.60	5.30
	II	4.70	5.00
	Avg.	5.15	5.15

D. Task

		sled	back
Phase	1	5.15	5.15
	2	5.20	5.10

E. Ration

		High	Low
Phase	1	5.00	5.30
	2	5.30	5.00

F. Task

		sled	back
Ration	High	5.25	5.05
	Low	5.10	5.20

G. Ration

			High	Low
Cycle	I	Phase 1	5.60	5.40
		Phase 2	5.60	5.20
	II	Phase 1	4.40	5.20
		Phase 2	5.00	4.80

H. Task

			sled	back
Cycle	I	Phase 1	5.30	5.70
		Phase 2	5.70	5.10
	II	Phase 1	5.00	4.60
		Phase 2	4.70	5.10

I. Ration

		Task	High	Low
Cycle	I	sled	5.70	5.30
		back	5.50	5.30
	II	sled	4.80	4.90
		back	4.60	5.10

J. Task

		Ration	sled	back
Phase	1	High	4.40	5.60
		Low	5.90	4.70
	2	High	6.10	4.50
		Low	4.30	5.70

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	4.60	6.60	6.00	4.80
		Phase 2	6.80	4.40	4.60	5.80
	II	Phase 1	4.20	4.60	5.80	4.60
		Phase 2	5.40	4.60	4.00	5.60

TABLE 31

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY TIREDNESS
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-6)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	9.1125	5.21	.05
Phases (t_2)	1	1.0125	<1	. .
Tasks (T)	1	2.1125	1.21	. .
Rations (R)	1	63.0125	36.01	.001
t_1t_2	1	0.0125	<1	. .
t_1T	1	2.1125	1.21	. .
t_1R	1	0.1125	<1	. .
t_2T	1	0.3125	<1	. .
t_2R	1	1.0125	<1	. .
TR	1	4.5125	2.58	. .
t_1t_2T	1	9.1125	5.21	.05
t_1t_2R	1	2.1125	1.21	. .
t_1TR	1	0.6125	<1	. .
t_2TR	1	1.0125	<1	. .
t_1t_2TR	1	1.5125	<1	. .
Residual	64	1.7500	. .	. .

TABLE 31--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.00	4.80	4.90
II	4.35	4.10	4.22
Avg.	4.68	4.45	4.56

B. Cycle × Task

Cycle	sled	back
I	4.90	4.90
II	3.90	4.55
Avg.	4.40	4.72

C. Cycle × Ration

Cycle	High	Low
I	4.05	5.75
II	3.30	5.15
Avg.	3.67	5.45

D. Phase × Task

Phase	sled	back
1	4.45	4.90
2	4.35	4.55

E. Phase × Ration

Phase	High	Low
1	3.90	5.45
2	3.45	5.45

F. Ration × Task

Ration	sled	back
High	3.75	3.60
Low	5.05	5.85

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.10	5.90
	Phase 2	4.00	5.60
II	Phase 1	3.70	5.00
	Phase 2	2.90	5.30

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.60	5.40
	Phase 2	5.20	4.40
II	Phase 1	4.30	4.40
	Phase 2	3.50	4.70

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.20	5.60
	back	3.90	5.90
II	sled	3.30	4.50
	back	3.30	5.80

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.80	4.00
	Low	5.10	5.80
2	High	3.70	3.20
	Low	5.00	5.90

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.60	4.60	5.60	6.20
	Phase 2	4.80	3.20	5.60	5.60
II	Phase 1	4.00	3.40	4.60	5.40
	Phase 2	2.60	3.20	4.40	6.20

TABLE 32

LEVEL OF BEING AFFECTED BY WEARINESS IN THE PAST FEW DAYS
(QUESTIONNAIRE B, ITEM 6-2)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	12.8000	7.53	.01
Phases (t_2)	1	0.0500	<1	. .
Tasks (T)	1	0.4500	<1	. .
Rations (R)	1	8.4500	4.97	.05
t_1t_2	1	0.8000	<1	. .
t_1T	1	0.2000	<1	. .
t_1R	1	3.2000	1.88	. .
t_2T	1	0.0500	<1	. .
t_2R	1	0.4500	<1	. .
TR	1	2.4500	1.44	. .
t_1t_2T	1	9.8000	5.76	.05
t_1t_2R	1	1.8000	1.06	. .
t_1TR	1	0.2000	<1	. .
t_2TR	1	0.4500	<1	. .
t_1t_2TR	1	0.8000	<1	. .
Residual	64	1.7000	. .	. .

TABLE 32--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	5.40	5.65	5.52
II	4.80	4.65	4.72
Avg.	5.10	5.15	5.12

B.

Cycle	Task: sled	Task: back
I	5.55	5.50
II	4.85	4.60
Avg.	5.20	5.05

C.

Cycle	Ration: High	Ration: Low
I	5.40	5.65
II	4.20	5.25
Avg.	4.80	5.45

D.

Phase	Task: sled	Task: back
1	5.20	5.00
2	5.20	5.10

E.

Phase	Ration: High	Ration: Low
1	4.85	5.35
2	4.75	5.55

F.

Ration	Task: sled	Task: back
High	4.70	4.90
Low	5.70	5.20

G.

Cycle		Ration: High	Ration: Low
I	Phase 1	5.50	5.30
	Phase 2	5.30	6.00
II	Phase 1	4.20	5.40
	Phase 2	4.20	5.10

H.

Cycle		Task: sled	Task: back
I	Phase 1	5.10	5.70
	Phase 2	6.00	5.30
II	Phase 1	5.30	4.30
	Phase 2	4.40	4.90

I.

Cycle	Task	Ration: High	Ration: Low
I	sled	5.20	5.90
	back	5.60	5.40
II	sled	4.20	5.50
	back	4.20	5.00

J.

Phase	Ration	Task: sled	Task: back
1	High	4.70	5.00
	Low	5.70	5.00
2	High	4.70	4.80
	Low	5.70	5.40

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	4.80	6.20	5.40	5.20
	Phase 2	5.60	5.00	6.40	5.60
II	Phase 1	4.60	3.80	6.00	4.80
	Phase 2	3.80	4.60	5.00	5.20

TABLE 33

LEVEL OF ANNOYANCE AND IRRITATION WITH FATIGUE AND WEARINESS IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-6)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.5125	3.53	.10
Phases (t_2)	1	5.5125	3.53	.10
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	12.0125	7.69	.01
t_1t_2	1	2.1125	1.35	. .
t_1T	1	6.6125	4.23	.05
t_1R	1	0.0125	<1	. .
t_2T	1	0.0125	<1	. .
t_2R	1	1.0125	<1	. .
TR	1	0.6125	<1	. .
t_1t_2T	1	0.3125	<1	. .
t_1t_2R	1	3.6125	2.31	. .
t_1TR	1	1.5125	<1	. .
t_2TR	1	5.5125	3.53	.10
t_1t_2TR	1	2.8125	1.80	. .
Residual	64	1.5625	. .	. .

TABLE 33—Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	4.70	5.55	5.13
II	4.50	4.70	4.60
Avg.	4.60	5.13	4.86

B.

Cycle	Task sled	Task back
I	5.35	4.90
II	4.25	4.95
Avg.	4.80	4.93

C.

Cycle	Ration High	Ration Low
I	4.75	5.50
II	4.20	5.00
Avg.	4.48	5.25

D.

Phase	Task sled	Task back
1	4.55	4.65
2	5.05	5.20

E.

Phase	Ration High	Ration Low
1	4.10	5.10
2	4.85	5.40

F.

Ration	Task sled	Task back
High	4.50	4.45
Low	5.10	5.40

G.

Cycle		Ration High	Ration Low
I	Phase 1	4.00	5.40
	Phase 2	5.50	5.60
II	Phase 1	4.20	4.80
	Phase 2	4.20	5.20

H.

Cycle		Task sled	Task back
I	Phase 1	5.00	4.40
	Phase 2	5.70	5.40
II	Phase 1	4.10	4.90
	Phase 2	4.40	5.00

I.

Cycle	Task	Ration High	Ration Low
I	sled	5.20	5.50
	back	4.30	5.50
II	sled	3.80	4.70
	back	4.60	5.30

J.

Phase	Ration	Task sled	Task back
1	High	4.40	3.80
	Low	4.70	5.50
2	High	4.60	5.10
	Low	5.50	5.30

K.

Cycle		Ration / Task High sled	High back	Low sled	Low back
I	Phase 1	4.60	3.40	5.40	5.40
	Phase 2	5.80	5.20	5.60	5.60
II	Phase 1	4.20	4.20	4.00	5.60
	Phase 2	3.40	5.00	5.40	5.00

TABLE 34

LEVEL OF TIREDNESS TODAY
(QUESTIONNAIRE C, ITEM 15-1)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.5125	4.34	.05
Phases (t_2)	1	0.1125	< 1	. .
Tasks (T)	1	6.6125	5.21	.05
Rations (R)	1	19.0125	14.98	.001
t_1t_2	1	2.8125	2.22	. .
t_1T	1	2.1125	1.66	. .
t_1R	1	3.6125	2.85	.10
t_2T	1	0.0125	< 1	. .
t_2R	1	4.5125	3.56	.10
TR	1	0.0125	< 1	. .
t_1t_2T	1	0.6125	< 1	. .
t_1t_2R	1	0.3125	< 1	. .
t_1TR	1	15.3125	12.07	.001
t_2TR	1	0.1125	< 1	. .
t_1t_2TR	1	1.2688	1.00	. .
Residual	64	1.2676	. .	. .

TABLE 34--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.75	5.30	5.52
II	4.85	5.15	5.00
Avg.	5.30	5.22	5.26

B. Cycle × Task

Cycle	sled	back
I	5.40	5.65
II	4.55	5.45
Avg.	4.98	5.55

C. Cycle × Ration

Cycle	High	Low
I	5.25	5.80
II	4.30	5.70
Avg.	4.78	5.75

D. Phase × Task

Phase	sled	back
1	5.00	5.60
2	4.95	5.50

E. Phase × Ration

Phase	High	Low
1	5.05	5.55
2	4.50	5.95

F. Ration × Task

Ration	sled	back
High	4.70	4.85
Low	5.25	6.25

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	5.80	5.70
	Phase 2	4.70	5.90
II	Phase 1	4.30	5.40
	Phase 2	4.30	6.00

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	5.60	5.90
	Phase 2	5.20	5.40
II	Phase 1	4.40	5.30
	Phase 2	4.70	5.60

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	5.40	5.40
	back	5.10	6.20
II	sled	4.00	5.10
	back	4.60	6.30

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	5.40	4.70
	Low	4.60	6.50
2	High	4.00	5.00
	Low	5.90	6.00

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	6.40	5.20	4.80	6.60
	Phase 2	4.40	5.00	6.00	5.80
II	Phase 1	4.40	4.20	4.40	6.40
	Phase 2	3.60	5.00	5.80	6.20

TABLE 35

LEVEL OF DIFFICULTY OF TRAIL-BREAKING
(QUESTIONNAIRE C, ITEM 13-1)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.4500	< 1	. .
Phases (t_2)	1	9.8000	2.79	.10
Tasks (T)	1	16.2000	4.61	.05
Rations (R)	1	9.8000	2.79	.10
t_1t_2	1	0.8000	< 1	. .
t_1T	1	7.2000	2.05	. .
t_1R	1	0.8000	< 1	. .
t_2T	1	8.4500	2.41	. .
t_2R	1	0.0500	< 1	. .
TR	1	4.0500	1.15	. .
t_1t_2T	1	0.0500	< 1	. .
t_1t_2R	1	0.4500	< 1	. .
t_1TR	1	2.4500	< 1	. .
t_2TR	1	3.2000	< 1	. .
t_1t_2TR	1	0.2000	< 1	. .
Residual	64	3.5125	. .	. .

TABLE 35--Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	4.40	3.50	3.95
	II	4.05	3.55	3.80
	Avg	4.22	3.52	3.88

B. Task

		sled	back
Cycle	I	3.80	4.10
	II	3.05	4.55
	Avg	3.42	4.32

C. Ration

		High	Low
Cycle	I	3.50	4.40
	II	3.55	4.05
	Avg	3.52	4.22

D. Task

		sled	back
Phase	1	4.10	4.35
	2	2.75	4.30

E. Ration

		High	Low
Phase	1	3.90	4.55
	2	3.15	3.90

F. Task

		sled	back
Ration	High	3.30	3.75
	Low	3.55	4.90

G. Ration

			High	Low
Cycle	I	Phase 1	3.90	4.90
		Phase 2	3.10	3.90
	II	Phase 1	3.90	4.20
		Phase 2	3.20	3.90

H. Task

			sled	back
Cycle	I	Phase 1	4.60	4.20
		Phase 2	3.00	4.00
	II	Phase 1	3.60	4.50
		Phase 2	2.50	4.60

I. Ration

		Task	High	Low
Cycle	I	sled	3.40	4.20
		back	3.60	4.60
	II	sled	3.20	2.90
		back	3.90	5.20

J. Task

		Ration	sled	back
Phase	1	High	3.80	4.00
		Low	4.40	4.70
	2	High	2.80	3.50
		Low	2.70	5.10

K. Ration / Task

			High		Low	
			sled	back	sled	back
Cycle	I	Phase 1	4.00	3.80	5.20	4.60
		Phase 2	2.80	3.40	3.20	4.60
	II	Phase 1	3.60	4.20	3.60	4.80
		Phase 2	2.80	3.60	2.20	5.60

TABLE 36

LEVEL OF DIFFICULTY OF HAULING FIRST SLED
(QUESTIONNAIRE C, ITEM 13-2)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0125	<1	. .
Phases (t_2)	1	1.0125	<1	. .
Tasks (T)	1	1.5125	<1	. .
Rations (R)	1	9.1125	2.80	.10
t_1t_2	1	1.0125	<1	. .
t_1T	1	7.8125	2.40	. .
t_1R	1	4.5125	1.39	. .
t_2T	1	0.1125	<1	. .
t_2R	1	1.0125	<1	. .
TR	1	1.0125	<1	. .
t_1t_2T	1	6.6125	2.03	. .
t_1t_2R	1	0.6125	<1	. .
t_1TR	1	0.3125	<1	. .
t_2TR	1	2.1125	<1	. .
t_1t_2TR	1	0.0125	<1	. .
Residual	64	3.2562	. .	. .

TABLE 36--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	4.55	4.10	4.32
II	4.30	4.30	4.30
Avg.	4.42	4.20	4.31

B. Cycle × Task

Cycle	Task sled	Task back
I	4.50	4.15
II	3.85	4.75
Avg.	4.18	4.45

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	3.75	4.90
II	4.20	4.40
Avg.	3.98	4.65

D. Phase × Task

Phase	Task sled	Task back
1	4.25	4.60
2	4.10	4.30

E. Phase × Ration

Phase	Ration High	Ration Low
1	4.20	4.65
2	3.75	4.65

F. Ration × Task

Ration	Task sled	Task back
High	3.95	4.00
Low	4.40	4.90

G.

Cycle		Ration High	Ration Low
I	Phase 1	4.00	5.10
	Phase 2	3.50	4.70
II	Phase 1	4.40	4.20
	Phase 2	4.00	4.60

H.

Cycle		Task sled	Task back
I	Phase 1	4.40	4.70
	Phase 2	4.60	3.60
II	Phase 1	4.10	4.50
	Phase 2	3.60	5.00

I.

Cycle	Task	Ration High	Ration Low
I	sled	4.10	4.90
	back	3.40	4.90
II	sled	3.80	3.90
	back	4.60	4.90

J.

Phase	Ration	Task sled	Task back
1	High	4.30	4.10
	Low	4.20	5.10
2	High	3.60	3.90
	Low	4.60	4.70

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	3.80	4.60	5.60
	Phase 2	4.00	3.00	5.20	4.20
II	Phase 1	4.40	4.40	3.80	4.60
	Phase 2	3.20	4.80	4.00	5.20

TABLE 37

LEVEL OF DIFFICULTY OF HAULING SECOND SLED
(QUESTIONNAIRE C, ITEM 13-3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.5125	< 1	. .
Phases (t_2)	1	3.6125	1.43	. .
Tasks (T)	1	0.3125	< 1	. .
Rations (R)	1	3.6125	1.43	. .
t_1t_2	1	3.6125	1.43	. .
t_1T	1	0.6125	< 1	. .
t_1R	1	19.0125	7.53	.01
t_2T	1	0.1125	< 1	. .
t_2R	1	0.0125	< 1	. .
TR	1	3.6125	1.43	. .
t_1t_2T	1	1.0125	< 1	. .
t_1t_2R	1	0.0125	< 1	. .
t_1TR	1	0.1125	< 1	. .
t_2TR	1	4.5125	1.79	. .
t_1t_2TR	1	0.6125	< 1	. .
Residual	64	2.5250	. .	. .

TABLE 37—Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	4.20	4.20	4.20
	II	4.05	4.90	4.48
	Avg.	4.12	4.55	4.34

B. Task

		sled	back
Cycle	I	4.35	4.05
	II	4.45	4.60
	Avg.	4.40	4.28

C. Ration

		High	Low
Cycle	I	8.50	4.90
	II	4.75	4.20
	Avg.	4.12	4.55

D. Task

		sled	back
Phase	1	4.15	4.10
	2	4.65	4.45

E. Ration

		High	Low
Phase	1	3.90	4.85
	2	4.35	4.75

F. Task

		sled	back
Ration	High	4.40	3.85
	Low	4.40	4.70

G. Ration

			High	Low
Cycle	I	Phase 1	3.50	4.90
		Phase 2	3.50	4.90
	II	Phase 1	4.30	3.80
		Phase 2	5.20	4.60

H. Task

			sled	back
Cycle	I	Phase 1	4.20	4.20
		Phase 2	4.50	3.90
	II	Phase 1	4.10	4.00
		Phase 2	4.80	5.00

I. Ration

		Task	High	Low
Cycle	I	sled	3.90	4.80
		back	3.10	5.00
	II	sled	4.90	4.00
		back	4.60	4.40

J. Task

		Ration	sled	back
Phase	1	High	3.90	3.90
		Low	4.40	4.30
	2	High	4.90	3.80
		Low	4.40	5.10

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	3.60	3.40	4.80	5.00
		Phase 2	4.20	2.80	4.80	5.00
	II	Phase 1	4.20	4.40	4.00	3.60
		Phase 2	5.60	4.80	4.00	5.20

TABLE 38

LEVEL OF DIFFICULTY OF THREE TRAIL POSITIONS
(QUESTIONNAIRE C, ITEMS 13-1, 13-2 AND 13-3)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0133	< 1	. .
Phases (t_2)	1	0.3333	1.10	. .
Tasks (T)	1	1.4700	4.85	.10
Rations (R)	1	4.3200	14.25	.01
t_1t_2	1	0.9633	3.18	. .
t_1T	1	2.6133	8.62	.05
t_1R	1	3.6300	11.97	.01
t_2T	1	0.3333	1.10	. .
t_2R	1	0.0833	< 1	. .
TR	1	1.6133	5.32	.05
t_1t_2T	1	0.7500	2.47	. .
t_1t_2R	1	0.1200	< 1	. .
t_1TR	1	0.0300	< 1	. .
t_2TR	1	0.4033	1.33	. .
t_1t_2TR	1	0.1200	< 1	. .

TABLE 38--Continued

Source of Variation	d. f.	Mean Square	F	Significance Level
Positions (P)	2	1.0825	3.57	.10
Pt_1	2	0.1908	< 1	. .
Pt_2	2	1.2758	4.21	.10
PT	2	1.0675	3.52	.10
PR	2	0.0925	< 1	. .
Pt_1t_2	2	0.0608	< 1	. .
Pt_1T	2	0.2558	< 1	. .
Pt_1R	2	0.6175	2.04	. .
Pt_2T	2	0.7008	2.31	. .
Pt_2R	2	0.0658	< 1	. .
PTR	2	0.0608	< 1	. .
Residual	10	0.3032	. .	. .

TABLE 39

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY COLD
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-2)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	7.8125	2.99	.10
Phases (t_2)	1	0.0125	<1	. .
Tasks (T)	1	3.6125	1.38	. .
Rations (R)	1	0.0125	<1	. .
t_1t_2	1	1.0125	<1	. .
t_1T	1	0.6125	<1	. .
t_1R	1	0.1125	<1	. .
t_2T	1	0.1125	<1	. .
t_2R	1	10.5125	4.02	.05
TR	1	1.0125	<1	. .
t_1t_2T	1	0.1125	<1	. .
t_1t_2R	1	2.8125	1.08	. .
t_1TR	1	0.3125	<1	. .
t_2TR	1	7.8125	2.99	.10
t_1t_2TR	1	15.3125	5.86	.05
esidual	64	2.6125	. .	. .

TABLE 39--Continued

Mean Values

A. Cycle × Phase

	Phase 1	Phase 2	Avg.
Cycle I	4.35	4.10	4.22
Cycle II	3.50	3.70	3.60
Avg.	3.92	3.90	3.91

B. Cycle × Task

	Task sled	Task back
Cycle I	4.10	4.35
Cycle II	3.30	3.90
Avg.	3.70	4.12

C. Cycle × Ration

	Ration High	Ration Low
Cycle I	4.75	4.70
Cycle II	3.55	3.65
Avg.	3.90	3.92

D. Phase × Task

	Task sled	Task back
Phase 1	3.75	4.05
Phase 2	3.65	4.15

E. Phase × Ration

	Ration High	Ration Low
Phase 1	3.55	4.30
Phase 2	4.75	3.55

F. Ration × Task

	Task sled	Task back
Ration High	3.80	4.00
Ration Low	3.60	4.25

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.20	4.50
	Phase 2	4.30	3.90
II	Phase 1	2.90	4.10
	Phase 2	4.20	3.20

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.30	4.40
	Phase 2	3.90	4.30
II	Phase 1	3.20	3.80
	Phase 2	3.40	4.00

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.30	3.90
	back	4.20	4.50
II	sled	3.30	3.30
	back	3.80	4.00

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.80	3.30
	Low	3.70	4.90
2	High	3.80	4.70
	Low	3.50	3.60

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	4.20	4.40	4.60
	Phase 2	4.40	4.20	3.40	4.40
II	Phase 1	3.40	2.40	3.00	5.20
	Phase 2	3.20	5.20	3.60	2.80

TABLE 40

LEVEL OF BEING AFFECTED BY COLD IN THE PAST FEW DAYS
(QUESTIONNAIRE B, ITEM 6-6)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.6125	<1	. .
Phases (t_2)	1	4.5125	1.86	. .
Tasks (T)	1	1.5125	<1	. .
Rations (R)	1	0.3125	<1	. .
t_1t_2	1	2.8125	1.16	. .
t_1T	1	1.5125	<1	. .
t_1R	1	9.1125	3.76	.10
t_2T	1	0.1125	<1	. .
t_2R	1	0.0125	<1	. .
TR	1	1.5125	<1	. .
t_1t_2T	1	3.6125	1.49	. .
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	2.1125	<1	. .
t_2TR	1	25.3125	10.44	.01
t_1t_2TR	1	1.0125	<1	. .
Residual	64	2.4250	. .	. .

TABLE 40—Continued

Mean Values

A.

		Phase 1	Phase 2	Avg.
Cycle	I	4.45	4.55	4.50
	II	3.90	4.75	4.32
	Avg.	4.18	4.65	4.41

B.

		Task: sled	back
Cycle	I	4.50	4.50
	II	4.05	4.60
	Avg.	4.28	4.55

C.

		Ration: High	Low
Cycle	I	4.90	4.10
	II	4.05	4.60
	Avg.	4.48	4.35

D.

		Task: sled	back
Phase	1	4.00	4.35
	2	4.55	4.75

E.

		Ration: High	Low
Phase	1	4.25	4.10
	2	4.70	4.60

F.

		Task: sled	back
Ration	High	4.20	4.75
	Low	4.35	4.35

G.

			Ration: High	Low
Cycle	I	Phase 1	4.90	4.00
		Phase 2	4.90	4.20
	II	Phase 1	3.60	4.20
		Phase 2	4.50	5.00

H.

			Task: sled	back
Cycle	I	Phase 1	4.20	4.70
		Phase 2	4.80	4.30
	II	Phase 1	3.80	4.00
		Phase 2	4.30	5.20

I.

		Task	Ration: High	Low
Cycle	I	sled	4.60	4.40
		back	5.20	3.80
	II	sled	3.80	4.30
		back	4.30	4.90

J.

		Ration	Task: sled	back
Phase	1	High	4.50	4.00
		Low	3.50	4.70
	2	High	3.90	5.50
		Low	5.20	4.00

K.

			Ration / Task: High sled	High back	Low sled	Low back
Cycle	I	Phase 1	4.80	5.00	3.60	4.40
		Phase 2	4.40	5.40	5.20	3.20
	II	Phase 1	4.20	3.00	3.40	5.00
		Phase 2	3.40	5.60	5.20	4.80

TABLE 41

LEVEL OF ANNOYANCE AND IRRITATION WITH COLD IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-16)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	11.2500	3.52	.10
Phases (t_2)	1	0.0500	< 1	. .
Tasks (T)	1	0.2000	< 1	. .
Rations (R)	1	2.4500	< 1	. .
t_1t_2	1	1.2500	< 1	. .
t_1T	1	1.8000	< 1	. .
t_1R	1	1.2500	< 1	. .
t_2T	1	5.0000	1.57	. .
t_2R	1	0.0500	< 1	. .
TR	1	1.8000	< 1	. .
t_1t_2T	1	1.8000	< 1	. .
t_1t_2R	1	0.0500	< 1	. .
t_1TR	1	0.2000	< 1	. .
t_2TR	1	3.2000	1.00	. .
t_1t_2TR	1	7.2000	2.25	. .
Residual	64	3.1938	. .	. .

TABLE 41--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	4.50	4.20	4.35
II	3.50	3.70	3.60
Avg.	4.00	3.95	3.98

B. Cycle × Task

Cycle	sled	back
I	4.45	4.25
II	3.40	3.80
Avg.	3.92	4.02

C. Cycle × Ration

Cycle	High	Low
I	4.30	4.40
II	3.30	3.90
Avg.	3.80	4.15

D. Phase × Task

Phase	sled	back
1	3.70	4.30
2	4.15	3.75

E. Phase × Ration

Phase	High	Low
1	3.85	4.15
2	3.75	4.15

F. Ration × Task

Ration	sled	back
High	3.90	3.70
Low	3.95	4.35

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.50	4.50
	Phase 2	4.10	4.30
II	Phase 1	3.20	3.80
	Phase 2	3.40	4.00

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.20	4.80
	Phase 2	4.70	3.70
II	Phase 1	3.20	3.80
	Phase 2	3.60	3.80

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.50	4.40
	back	4.10	4.40
II	sled	3.30	3.50
	back	3.30	4.30

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.90	3.80
	Low	3.50	4.80
2	High	3.90	3.60
	Low	4.40	3.90

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	4.80	4.20	4.80
	Phase 2	4.80	3.40	4.60	4.00
II	Phase 1	3.60	2.80	2.80	4.80
	Phase 2	3.00	3.80	4.20	3.80

TABLE 42

LEVEL OF RAPIDITY (SPEED) THAT THE PAST HOUR SEEMED TO GO BY (NOON HOUR QUESTIONNAIRE [A], ITEM 3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	7.2000	4.40	.05
Phases (t_2)	1	0.0500	<1	. .
Tasks (T)	1	0.4500	<1	. .
Rations (R)	1	0.2000	<1	. .
t_1t_2	1	0.2000	<1	. .
t_1T	1	0.8000	<1	. .
t_1R	1	4.0500	2.47	. .
t_2T	1	8.4500	5.16	.05
t_2R	1	0.0000	<1	. .
TR	1	0.8000	<1	. .
t_1t_2T	1	5.0000	3.05	.10
t_1t_2R	1	0.0500	<1	. .
t_1TR	1	2.4500	1.50	. .
t_2TR	1	1.8000	1.10	. .
t_1t_2TR	1	8.4500	5.16	.05
Residual	64	1.6375	. .	. .

TABLE 42—Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Phase Avg.
I	3.90	3.75	3.82
II	4.40	4.45	4.42
Avg.	4.15	4.10	4.12

B.

Cycle	Task sled	Task back
I	3.80	3.85
II	4.60	4.25
Avg.	4.20	4.05

C.

Cycle	Ration High	Ration Low
I	3.65	4.00
II	4.70	4.15
Avg.	4.18	4.08

D.

Phase	Task sled	Task back
1	3.90	4.40
2	4.50	3.70

E.

Phase	Ration High	Ration Low
1	4.20	4.10
2	4.15	4.05

F.

Ration	Task sled	Task back
High	4.15	4.20
Low	4.25	3.90

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.70	4.10
	Phase 2	3.60	3.90
II	Phase 1	4.70	4.10
	Phase 2	4.70	4.20

H.

Cycle		Task sled	Task back
I	Phase 1	3.80	4.00
	Phase 2	3.80	3.70
II	Phase 1	4.00	4.80
	Phase 2	5.20	3.70

I.

Cycle	Task	Ration High	Ration Low
I	sled	3.70	3.90
	back	3.60	4.10
II	sled	4.60	4.60
	back	4.80	3.70

J.

Phase	Ration	Task sled	Task back
1	High	3.70	4.70
	Low	4.10	4.10
2	High	4.60	3.70
	Low	4.40	3.70

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	3.20	4.20	4.40	3.80
	Phase 2	4.20	3.00	3.40	4.40
II	Phase 1	4.20	5.20	3.80	4.40
	Phase 2	5.00	4.40	5.40	3.00

TABLE 43

LEVEL OF ANNOYANCE AND IRRITATION WITH
OVERHEATING IN THE PAST DAY OR TWO
(QUESTIONNAIRE C, ITEM 1A-9)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0125	<1	. .
Phases (t_2)	1	2.1125	2.52	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	0.0125	<1	. .
t_1t_2	1	1.0125	1.21	. .
t_1T	1	7.8125	9.33	.01
t_1R	1	0.6125	<1	. .
t_2T	1	1.0125	1.21	. .
t_2R	1	5.5125	6.58	.05
TR	1	9.1125	10.88	.01
t_1t_2T	1	0.6125	<1	. .
t_1t_2R	1	0.0125	<1	. .
t_1TR	1	0.0125	<1	. .
t_2TR	1	0.6125	<1	. .
t_1t_2TR	1	0.0125	<1	. .
Residual	64	0.8375	. .	. .

TABLE 43--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	3.55	3.00	3.28
II	3.35	3.25	3.30
Avg.	3.45	3.12	3.29

B. Task

Cycle	sled	back
I	3.65	2.90
II	3.05	3.55
Avg.	3.35	3.22

C. Ration

Cycle	High	Low
I	3.20	3.33
II	3.40	3.20
Avg.	3.30	3.28

D. Task

Phase	sled	back
1	3.40	3.50
2	3.30	2.95

E. Ration

Phase	High	Low
1	3.20	3.70
2	3.40	2.85

F. Task

Ration	sled	back
High	3.70	2.90
Low	3.00	3.55

G. Ration

Cycle		High	Low
I	Phase 1	3.20	3.90
	Phase 2	3.20	2.80
II	Phase 1	3.20	3.50
	Phase 2	3.60	2.90

H. Task

Cycle		sled	back
I	Phase 1	3.90	3.20
	Phase 2	3.40	2.60
II	Phase 1	2.90	3.80
	Phase 2	3.20	3.30

I. Ration

Cycle	Task	High	Low
I	sled	3.90	3.40
	back	2.50	3.30
II	sled	3.50	2.60
	back	3.30	3.80

J. Task

Phase	Ration	sled	back
1	High	3.40	3.00
	Low	3.40	4.00
2	High	4.00	2.80
	Low	2.60	3.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.80	2.60	4.00	3.80
	Phase 2	4.00	2.40	2.80	2.80
II	Phase 1	3.00	3.40	2.80	4.20
	Phase 2	4.00	3.20	2.40	3.40

TABLE 44

LEVEL OF BEING AFFECTED BY OVERHEATING IN THE PAST FEW DAYS
(QUESTIONNAIRE B, ITEM 6-3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.4500	<1	. .
Phases (t_2)	1	3.2000	1.97	. .
Tasks (T)	1	1.2500	<1	. .
Rations (R)	1	0.2000	<1	. .
t_1t_2	1	1.2500	<1	. .
t_1T	1	0.8000	<1	. .
t_1R	1	0.0500	<1	. .
t_2T	1	1.2500	<1	. .
t_2R	1	0.0000	<1	. .
TR	1	0.0500	<1	. .
t_1t_2T	1	0.2000	<1	. .
t_1t_2R	1	0.0500	<1	. .
t_1TR	1	1.8000	<1	. .
t_2TR	1	0.0500	<1	. .
t_1t_2TR	1	0.2000	<1	. .
Residual	64	1.6250	. .	. .

TABLE 44—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	3.60	2.95	3.28
II	3.20	3.05	3.12
Avg.	3.40	3.00	3.20

B. Task

Cycle	sled	back
I	3.05	3.50
II	3.10	3.15
Avg.	3.08	3.32

C. Ration

Cycle	High	Low
I	3.25	3.30
II	3.05	3.20
Avg.	3.15	3.25

D. Task

Phase	sled	back
1	3.15	3.65
2	3.00	3.00

E. Ration

Phase	High	Low
1	3.35	3.45
2	2.95	3.05

F. Task

Ration	sled	back
High	3.05	3.25
Low	3.10	3.40

G. Ration

Cycle		High	Low
I	Phase 1	3.60	3.60
	Phase 2	2.90	3.00
II	Phase 1	3.10	3.30
	Phase 2	3.00	3.10

H. Task

Cycle		sled	back
I	Phase 1	3.20	4.00
	Phase 2	2.90	3.00
II	Phase 1	3.10	3.30
	Phase 2	3.10	3.00

I. Ration

Cycle	Task	High	Low
I	sled	2.90	3.20
	back	3.60	3.40
II	sled	3.20	3.00
	back	2.90	3.40

J. Task

Phase	Ration	sled	back
1	High	3.10	3.60
	Low	3.20	3.70
2	High	3.00	2.90
	Low	3.00	3.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.00	4.20	3.40	3.80
	Phase 2	2.80	3.00	3.00	3.00
II	Phase 1	3.20	3.00	3.00	3.60
	Phase 2	3.20	2.80	3.00	3.20

TABLE 45

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY OVERHEATING
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-5)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.2500	<1	. .
Phases (t_2)	1	0.4500	<1	. .
Tasks (T)	1	7.2000	3.67	.10
Rations (R)	1	0.4500	<1	. .
t_1t_2	1	0.8000	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	0.2000	<1	. .
t_2T	1	1.2500	<1	. .
t_2R	1	0.2000	<1	. .
TR	1	0.0500	<1	. .
t_1t_2T	1	3.2000	1.63	. .
t_1t_2R	1	0.4500	<1	. .
t_1TR	1	1.8000	<1	. .
t_2TR	1	7.2000	3.67	.10
t_1t_2TR	1	0.0500	<1	. .
Residual	64	1.9625	. .	. .

TABLE 45—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	2.55	2.90	2.72
II	3.00	2.95	2.98
Avg.	2.78	2.92	2.85

B. Task

Cycle	sled	back
I	3.00	2.45
II	3.30	2.65
Avg.	3.15	2.55

C. Ration

Cycle	High	Low
I	2.60	2.85
II	2.95	3.00
Avg.	2.78	2.92

D. Task

Phase	sled	back
1	2.95	2.60
2	3.35	2.50

E. Ration

Phase	High	Low
1	2.75	2.80
2	2.80	3.05

F. Task

Ration	sled	back
High	3.05	2.50
Low	3.25	2.60

G. Ration

Cycle		High	Low
I	Phase 1	2.40	2.70
	Phase 2	2.80	3.00
II	Phase 1	3.10	2.90
	Phase 2	2.80	3.10

H. Task

Cycle		sled	back
I	Phase 1	2.50	2.60
	Phase 2	3.50	2.30
II	Phase 1	3.40	2.60
	Phase 2	3.20	2.70

I. Ration

Cycle	Task	High	Low
I	sled	3.00	3.00
	back	2.20	2.70
II	sled	3.10	3.50
	back	2.80	2.50

J. Task

Phase	Ration	sled	back
1	High	2.60	2.90
	Low	3.30	2.30
2	High	3.50	2.10
	Low	3.20	2.90

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	2.20	2.60	2.80	2.60
	Phase 2	3.80	1.80	3.20	2.80
II	Phase 1	3.00	3.20	3.80	2.00
	Phase 2	3.20	2.40	3.20	3.00

TABLE 46

LEVEL OF ANNOYANCE AND IRRITATION WITH
THIRST IN THE PAST DAY OR TWO
(QUESTIONNAIRE C, ITEM 1A-3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.0125	<1	. .
Phases (t_2)	1	1.5125	1.31	. .
Tasks (T)	1	0.0125	<1	. .
Rations (R)	1	0.3125	<1	. .
t_1t_2	1	2.1125	1.83	. .
t_1T	1	0.0125	<1	. .
t_1R	1	0.3125	<1	. .
t_2T	1	5.5125	4.77	.05
t_2R	1	0.0125	<1	. .
TR	1	0.1125	<1	. .
t_1t_2T	1	13.6125	11.77	.01
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	0.0125	<1	. .
t_2TR	1	0.3125	<1	. .
t_1t_2TR	1	4.5125	3.90	.10
Residual	64	1.1563	. .	. .

TABLE 46--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	3.95	4.55	4.25
II	4.05	4.25	4.15
Avg.	4.00	4.40	4.20

B. Cycle × Task

Cycle	sled	back
I	4.25	4.25
II	4.05	4.25
Avg.	4.15	4.25

C. Cycle × Ration

Cycle	High	Low
I	4.25	4.25
II	3.90	4.40
Avg.	4.08	4.32

D. Phase × Task

Phase	sled	back
1	3.75	4.25
2	4.55	4.25

E. Phase × Ration

Phase	High	Low
1	3.95	4.05
2	4.20	4.60

F. Ration × Task

Ration	sled	back
High	4.05	4.10
Low	4.25	4.40

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.00	3.90
	Phase 2	4.50	4.60
II	Phase 1	3.90	4.20
	Phase 2	3.90	4.60

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.10	3.80
	Phase 2	4.40	4.70
II	Phase 1	3.40	4.70
	Phase 2	4.70	3.80

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.20	4.30
	back	4.30	4.20
II	sled	3.90	4.20
	back	3.90	4.60

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.60	4.30
	Low	3.90	4.20
2	High	4.50	3.90
	Low	4.60	4.60

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.80	4.20	4.40	3.40
	Phase 2	4.60	4.40	4.20	5.00
II	Phase 1	3.40	4.40	3.40	5.00
	Phase 2	4.40	3.40	5.00	4.20

TABLE 47

LEVEL OF BEING AFFECTED BY THIRST IN THE PAST FEW DAYS
(QUESTIONNAIRE B, ITEM 6-5)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	3.6125	2.09	. .
Phases (t_2)	1	1.5125	<1	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	2.8125	1.63	. .
t_1t_2	1	0.3125	<1	. .
t_1T	1	1.0125	<1	. .
t_1R	1	1.0125	<1	. .
t_2T	1	2.8125	1.63	. .
t_2R	1	0.0125	<1	. .
TR	1	0.3125	<1	. .
t_1t_2T	1	2.8125	1.63	. .
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	1.5125	<1	. .
t_2TR	1	7.8125	4.53	.05
t_1t_2TR	1	0.1125	<1	. .
Residual	64	1.7250	. .	. .

TABLE 47—Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	4.65	4.25	4.45
II	4.10	3.95	4.02
Avg.	4.38	4.10	4.24

B. Cycle × Task

Cycle	Task sled	Task back
I	4.40	4.50
II	4.20	3.85
Avg.	4.30	4.18

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	4.15	4.75
II	3.95	4.10
Avg.	4.05	4.42

D. Phase × Task

Phase	Task sled	Task back
1	4.25	4.50
2	4.35	3.85

E. Phase × Ration

Phase	Ration High	Ration Low
1	4.20	4.55
2	3.90	4.30

F. Ration × Task

Ration	Task sled	Task back
High	4.05	4.05
Low	4.55	4.30

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.40	4.90
	Phase 2	3.90	4.60
II	Phase 1	4.00	4.20
	Phase 2	3.90	4.00

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.60	4.70
	Phase 2	4.20	4.30
II	Phase 1	3.90	4.30
	Phase 2	4.50	3.40

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	3.90	4.90
	back	4.40	4.60
II	sled	4.20	4.20
	back	3.70	4.00

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.70	4.70
	Low	4.80	4.30
2	High	4.40	3.40
	Low	4.30	4.30

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.80	5.00	5.40	4.40
	Phase 2	4.00	3.80	4.40	4.80
II	Phase 1	3.60	4.40	4.20	4.20
	Phase 2	4.80	3.00	4.20	3.80

TABLE 48

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY THIRST
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-9)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.8000	<1	. .
Phases (t_2)	1	0.2000	<1	. .
Tasks (T)	1	1.2500	<1	. .
Rations (R)	1	0.2000	<1	. .
t_1t_2	1	0.0500	<1	. .
t_1T	1	0.2000	<1	. .
t_1R	1	0.0500	<1	. .
t_2T	1	12.8000	5.66	0.05
t_2R	1	0.8000	<1	. .
TR	1	4.0500	1.79	. .
t_1t_2T	1	0.0500	<1	. .
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	2.4500	1.08	. .
t_2TR	1	0.4500	<1	. .
t_1t_2TR	1	0.0000	<1	. .
Residual	64	2.2625	. .	. .

TABLE 48--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	3.90	3.85	3.88
II	3.65	3.50	3.58
Avg.	3.78	3.68	3.73

B. Cycle × Task

Cycle	Task sled	Task back
I	4.05	3.70
II	3.65	3.50
Avg.	3.85	3.60

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	3.85	3.90
II	3.50	3.65
Avg.	3.68	3.78

D. Phase × Task

Phase	Task sled	Task back
1	3.50	4.05
2	4.20	3.15

E. Phase × Ration

Phase	Ration High	Ration Low
1	3.95	3.60
2	3.40	3.95

F. Ration × Task

Ration	Task sled	Task back
High	3.70	3.65
Low	4.00	3.55

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	4.00	3.80
	Phase 2	3.70	4.00
II	Phase 1	3.90	3.40
	Phase 2	3.10	3.90

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	3.70	4.10
	Phase 2	4.40	3.30
II	Phase 1	3.30	4.00
	Phase 2	4.00	3.00

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.10	4.00
	back	3.60	3.80
II	sled	3.30	4.00
	back	3.70	3.30

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.50	4.40
	Low	3.50	3.70
2	High	3.90	2.90
	Low	4.50	3.40

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.80	4.20	3.60	4.00
	Phase 2	4.40	3.00	4.40	3.60
II	Phase 1	3.20	4.60	3.40	3.40
	Phase 2	3.40	2.80	4.60	3.20

TABLE 49

LEVEL OF ANNOYANCE AND IRRITATION WITH WATER-MELTING IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-12)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	13.6125	13.04	.001
Phases (t_2)	1	1.0125	<1	. .
Tasks (T)	1	0.1125	<1	. .
Rations (R)	1	1.8000	1.72	. .
t_1t_2	1	1.5125	1.45	. .
t_1T	1	0.3125	<1	. .
t_1R	1	0.6125	<1	. .
t_2T	1	0.3125	<1	. .
t_2R	1	5.5125	5.28	.05
TR	1	12.0125	11.51	.01
t_1t_2T	1	3.6125	3.46	.10
t_1t_2R	1	0.3125	<1	. .
t_1TR	1	0.3125	<1	. .
t_2TR	1	0.6125	<1	. .
t_1t_2TR	1	3.6125	3.46	.10
Residual	64	1.0438	. .	. .

TABLE 49—Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	4.10	4.15	4.12
II	3.55	3.05	3.30
Avg.	3.82	3.60	3.71

B. Cycle × Task

Cycle	Task sled	Task back
I	4.15	4.10
II	3.20	3.40
Avg.	3.68	3.75

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	4.05	4.20
II	3.05	3.55
Avg.	3.55	3.88

D. Phase × Task

Phase	Task sled	Task back
1	3.85	3.80
2	3.50	3.70

E. Phase × Ration

Phase	Ration High	Ration Low
1	3.40	4.25
2	3.70	3.50

F. Ration × Task

Ration	Task sled	Task back
High	3.90	3.20
Low	3.45	4.30

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	3.70	4.50
	Phase 2	4.40	3.90
II	Phase 1	3.10	4.00
	Phase 2	3.00	3.10

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.40	3.80
	Phase 2	3.90	4.40
II	Phase 1	3.30	3.80
	Phase 2	3.10	3.00

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.40	3.90
	back	3.70	4.50
II	sled	3.40	3.00
	back	2.70	4.10

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.90	2.90
	Low	3.80	4.70
2	High	3.90	3.50
	Low	3.10	3.90

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	3.20	4.60	4.40
	Phase 2	4.60	4.20	3.20	4.60
II	Phase 1	3.60	2.60	3.00	5.00
	Phase 2	3.20	2.80	3.00	3.20

TABLE 50

LEVEL OF ANNOYANCE AND IRRITATION WITH COOKING IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-10)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	3.6125	3.50	.10
Phases (t_2)	1	2.8125	2.73	.10
Tasks (T)	1	1.5125	1.47	. .
Rations (R)	1	3.6125	3.50	.10
t_1t_2	1	0.0125	<1	. .
t_1T	1	0.0125	<1	. .
t_1R	1	0.6125	<1	. .
t_2T	1	1.0125	<1	. .
t_2R	1	0.0125	<1	. .
TR	1	4.5125	4.38	.05
t_1t_2T	1	2.1125	2.05	. .
t_1t_2R	1	1.0125	<1	. .
t_1TR	1	3.6125	3.50	.10
t_2TR	1	0.6125	<1	. .
t_1t_2TR	1	0.1125	<1	. .
Residual	64	1.0312	. .	. .

TABLE 50—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	3.35	3.70	3.52
II	2.90	3.30	3.10
Avg.	3.12	3.50	3.31

B. Task

Cycle	sled	back
I	3.40	3.65
II	2.95	3.25
Avg.	3.18	3.45

C. Ration

Cycle	High	Low
I	3.40	3.65
II	2.80	3.40
Avg.	3.10	3.52

D. Task

Phase	sled	back
1	3.10	3.15
2	3.25	3.75

E. Ration

Phase	High	Low
1	2.90	3.35
2	3.30	3.70

F. Task

Ration	sled	back
High	3.20	3.00
Low	3.15	3.90

G. Ration

Cycle		High	Low
I	Phase 1	3.10	3.60
	Phase 2	3.70	3.70
II	Phase 1	2.70	3.10
	Phase 2	2.90	3.70

H. Task

Cycle		sled	back
I	Phase 1	3.50	3.20
	Phase 2	3.30	4.10
II	Phase 1	2.70	3.10
	Phase 2	3.20	3.40

I. Ration

Cycle	Task	High	Low
I	sled	3.30	3.50
	back	3.50	3.80
II	sled	3.10	2.80
	back	2.50	4.00

J. Task

Phase	Ration	sled	back
1	High	3.20	2.60
	Low	3.00	3.70
2	High	3.20	3.40
	Low	3.30	4.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.40	2.80	3.60	3.60
	Phase 2	3.20	4.20	3.40	4.00
II	Phase 1	3.00	2.40	2.40	3.80
	Phase 2	3.20	2.60	3.20	4.20

TABLE 51

LEVEL OF ANNOYANCE AND IRRITATION WITH SLEEPING CONDITIONS IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-4)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.4500	1.96	. .
Phases (t_2)	1	1.2500	1.00	. .
Tasks (T)	1	1.2500	1.00	. .
Rations (R)	1	0.0500	<1	. .
t_1t_2	1	0.0500	<1	. .
t_1T	1	11.2500	9.00	.01
t_1R	1	14.4500	11.56	.01
t_2T	1	6.0500	4.84	.05
t_2R	1	0.0500	<1	. .
TR	1	0.0500	<1	. .
t_1t_2T	1	0.4500	<1	. .
t_1t_2R	1	0.0500	<1	. .
t_1TR	1	0.0500	<1	. .
t_2TR	1	0.0500	<1	. .
t_1t_2TR	1	4.0500	3.24	.10
Residual	64	1.2500	. .	. .

TABLE 51--Continued

Mean Values

A.

		Phase 1	Phase 2	Avg.
Cycle	I	4.45	4.25	4.35
	II	4.15	3.85	4.00
	Avg.	4.30	4.05	4.17

B.

		Task sled	Task back
Cycle	I	4.85	3.85
	II	3.75	4.25
	Avg.	4.30	4.05

C.

		Ration High	Ration Low
Cycle	I	4.80	3.90
	II	3.60	4.40
	Avg.	4.20	4.15

D.

		Task sled	Task back
Phase	1	4.15	4.45
	2	4.45	3.65

E.

		Ration High	Ration Low
Phase	1	4.35	4.25
	2	4.05	4.05

F.

		Task sled	Task back
Ration	High	4.35	4.05
	Low	4.25	4.05

G.

			Ration High	Ration Low
Cycle	I	Phase 1	4.90	4.00
		Phase 2	4.70	3.80
	II	Phase 1	3.80	4.50
		Phase 2	3.40	4.30

H.

			Task sled	Task back
Cycle	I	Phase 1	4.60	4.30
		Phase 2	5.10	3.40
	II	Phase 1	3.70	4.60
		Phase 2	3.80	3.90

I.

		Task	Ration High	Ration Low
Cycle	I	sled	5.30	4.40
		back	4.30	3.40
	II	sled	3.40	4.10
		back	3.80	4.70

J.

		Ration	Task sled	Task back
Phase	1	High	4.20	4.50
		Low	4.10	4.40
	2	High	4.50	3.60
		Low	4.40	3.70

K.

			Ration / Task High sled	High back	Low sled	Low back
Cycle	I	Phase 1	4.80	5.00	4.40	3.60
		Phase 2	5.80	3.60	4.40	3.20
	II	Phase 1	3.60	4.00	3.80	5.20
		Phase 2	3.20	3.60	4.40	4.20

TABLE 52

LEVEL OF ANNOYANCE AND IRRITATION WITH HEALTH IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-7)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	7.8125	2.27	. .
Phases (t_2)	1	0.3125	<1	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	5.5125	1.60	. .
t_1t_2	1	0.1125	<1	. .
t_1T	1	0.0125	<1	. .
t_1R	1	3.6125	1.05	. .
t_2T	1	4.5125	1.31	. .
t_2R	1	0.0125	<1	. .
TR	1	2.1125	<1	. .
t_1t_2T	1	17.1125	4.98	.05
t_1t_2R	1	0.0125	<1	. .
t_1TR	1	0.6125	<1	. .
t_2TR	1	2.8125	<1	. .
t_1t_2TR	1	13.6125	3.96	.10
Residual	64	3.4375	. .	. .

TABLE 52--Continued

Mean Values

A. Cycle × Phase

		Phase 1	Phase 2	Avg.
Cycle	I	4.45	4.65	4.55
	II	3.90	3.95	3.92
	Avg.	4.18	4.30	4.24

B. Cycle × Task

		Task sled	Task back
Cycle	I	4.60	4.50
	II	4.00	3.85
	Avg.	4.30	4.18

C. Cycle × Ration

		Ration High	Ration Low
Cycle	I	4.50	4.40
	II	3.45	4.60
	Avg.	3.98	4.50

D. Phase × Task

		Task sled	Task back
Phase	1	4.00	4.35
	2	4.60	4.00

E. Phase × Ration

		Ration High	Ration Low
Phase	1	3.90	4.45
	2	4.05	4.55

F. Ration × Task

		Task sled	Task back
Ration	High	4.20	3.75
	Low	4.40	4.60

G.

			Ration High	Ration Low
Cycle	I	Phase 1	4.40	4.50
		Phase 2	4.60	4.70
	II	Phase 1	3.40	4.40
		Phase 2	3.50	4.40

H.

			Task sled	Task back
Cycle	I	Phase 1	3.80	5.10
		Phase 2	5.40	3.90
	II	Phase 1	4.20	3.60
		Phase 2	3.80	4.10

I.

		Task	Ration High	Ration Low
Cycle	I	sled	4.80	4.40
		back	4.20	4.80
	II	sled	3.60	4.40
		back	3.30	4.40

J.

		Ration	Task sled	Task back
Phase	1	High	3.70	4.10
		Low	4.30	4.60
	2	High	4.70	3.40
		Low	4.50	4.60

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	3.40	5.40	4.20	4.80
		Phase 2	6.20	3.00	4.60	4.80
	II	Phase 1	4.00	2.80	4.40	4.40
		Phase 2	3.20	3.80	4.40	4.40

TABLE 53

LEVEL OF ANNOYANCE AND IRRITATION WITH PERSONAL UNCLEANLINESS IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-14)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0125	< 1	. .
Phases (t_2)	1	4.5125	1.94	. .
Tasks (T)	1	0.1125	< 1	. .
Rations (R)	1	2.8125	1.21	. .
t_1t_2	1	1.5125	< 1	. .
t_1T	1	0.6125	< 1	. .
t_1R	1	0.0125	< 1	. .
t_2T	1	17.1125	7.34	.01
t_2R	1	0.1125	< 1	. .
TR	1	4.5125	1.94	. .
t_1t_2T	1	6.6125	2.84	.10
t_1t_2R	1	0.1125	< 1	. .
t_1TR	1	3.6125	1.55	. .
t_2TR	1	0.3125	< 1	. .
t_1t_2TR	1	12.0125	5.15	.05
Residual	64	2.3312	. .	. .

TABLE 53--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.20	5.40	5.30
II	4.95	5.70	5.32
Avg.	5.08	5.55	5.31

B. Cycle × Task

Cycle	Task sled	Task back
I	5.25	5.35
II	5.45	5.20
Avg.	5.35	5.28

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	5.10	5.50
II	5.15	5.50
Avg.	5.12	5.50

D. Phase × Task

Phase	Task sled	Task back
1	4.65	5.50
2	6.05	5.05

E. Phase × Ration

Phase	Ration High	Ration Low
1	4.85	5.30
2	5.40	5.70

F. Ration × Task

Ration	Task sled	Task back
High	5.40	4.85
Low	5.30	5.70

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	5.00	5.40
	Phase 2	5.20	5.60
II	Phase 1	4.70	5.20
	Phase 2	5.60	5.80

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	4.40	6.00
	Phase 2	6.10	4.70
II	Phase 1	4.90	5.00
	Phase 2	6.00	5.40

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	5.50	5.00
	back	4.70	6.00
II	sled	5.30	5.60
	back	5.00	5.40

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	4.60	5.10
	Low	4.70	5.90
2	High	6.20	4.60
	Low	5.90	5.50

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	5.80	4.60	6.20
	Phase 2	6.80	3.60	5.40	5.80
II	Phase 1	5.00	4.40	4.80	5.60
	Phase 2	5.60	5.60	6.40	5.20

TABLE 54

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY CHAPPING
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-1)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	13.6125	9.55	.01
Phases (t_2)	1	2.8125	1.97	. .
Tasks (T)	1	0.0125	<1	. .
Rations (R)	1	5.5125	3.87	.10
t_1t_2	1	0.6125	<1	. .
t_1T	1	3.6125	2.54	. .
t_1R	1	10.5125	7.38	.01
t_2T	1	2.1125	1.48	. .
t_2R	1	7.8125	5.48	.05
TR	1	1.0125	<1	. .
t_1t_2T	1	0.0125	<1	. .
t_1t_2R	1	2.1125	1.48	. .
t_1TR	1	1.5125	1.06	. .
t_2TR	1	0.1125	<1	. .
t_1t_2TR	1	23.1125	16.22	.001
Residual	64	1.4250	. .	. .

TABLE 54--Continued

Mean Values

A.

		Phase 1	Phase 2	Avg.
Cycle	I	3.75	3.95	3.85
	II	2.75	3.30	3.02
	Avg.	3.25	3.62	3.44

B.

		Task sled	Task back
Cycle	I	4.05	3.65
	II	2.80	3.25
	Avg.	3.42	3.45

C.

		Ration High	Ration Low
Cycle	I	3.75	3.95
	II	3.65	2.40
	Avg.	3.70	3.18

D.

		Task sled	Task back
Phase	1	3.40	3.10
	2	3.45	3.80

E.

		Ration High	Ration Low
Phase	1	3.20	3.30
	2	4.20	3.05

F.

		Task sled	Task back
Ration	High	3.80	3.60
	Low	3.05	3.30

G.

			Ration High	Ration Low
Cycle	I	Phase 1	3.50	4.00
		Phase 2	4.00	3.90
	II	Phase 1	2.90	2.60
		Phase 2	4.40	2.20

H.

			Task sled	Task back
Cycle	I	Phase 1	4.10	3.40
		Phase 2	4.00	3.90
	II	Phase 1	2.70	2.80
		Phase 2	2.90	3.70

I.

		Task	Ration High	Ration Low
Cycle	I	sled	4.20	3.90
		back	3.30	4.00
	II	sled	3.40	2.20
		back	3.90	2.60

J.

		Ration	Task sled	Task back
Phase	1	High	3.50	2.90
		Low	3.30	3.30
	2	High	4.10	4.30
		Low	2.80	3.30

K.

			Ration / Task High sled	High back	Low sled	Low back
Cycle	I	Phase 1	3.60	3.40	4.60	3.40
		Phase 2	4.80	3.20	3.20	4.60
	II	Phase 1	3.40	2.40	2.00	3.20
		Phase 2	3.40	5.40	2.40	2.00

TABLE 55

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY SORE FEET
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-12)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	7.2000	2.49	. .
Phases (t_2)	1	14.4500	4.99	.05
Tasks (T)	1	16.2000	5.60	.05
Rations (R)	1	3.2000	1.11	. .
t_1t_2	1	0.2000	<1	. .
t_1T	1	0.4500	<1	. .
t_1R	1	18.0500	6.24	.05
t_2T	1	9.8000	3.39	.10
t_2R	1	0.8000	<1	. .
TR	1	4.0500	1.40	. .
t_1t_2T	1	22.0500	7.62	.01
t_1t_2R	1	0.0500	<1	. .
t_1TR	1	0.0000	<1	. .
t_2TR	1	6.0500	2.09	. .
t_1t_2TR	1	0.2000	<1	. .
Residual	64	2.8938	. .	. .

TABLE 55—Continued

Mean Values

A.

		Phase 1	Phase 2	Phase Avg.
Cycle	I	2.95	2.00	2.48
	II	3.45	2.70	3.08
	Avg.	3.20	2.35	2.78

B.

		Task sled	Task back
Cycle	I	2.10	2.85
	II	2.55	3.60
	Avg.	2.32	3.22

C.

		Ration High	Ration Low
Cycle	I	2.75	2.20
	II	2.40	3.75
	Avg.	2.58	2.98

D.

		Task sled	Task back
Phase	1	2.40	4.00
	2	2.25	2.45

E.

		Ration High	Ration Low
Phase	1	2.90	3.50
	2	2.25	2.45

F.

		Task sled	Task back
Ration	High	2.35	2.80
	Low	2.30	3.65

G.

			Ration High	Ration Low
Cycle	I	Phase 1	3.10	2.80
		Phase 2	2.40	1.60
	II	Phase 1	2.70	4.20
		Phase 2	2.10	3.30

H.

			Task sled	Task back
Cycle	I	Phase 1	1.70	4.20
		Phase 2	2.50	1.50
	II	Phase 1	3.10	3.80
		Phase 2	2.00	3.40

I.

		Task	Ration High	Ration Low
Cycle	I	sled	2.60	1.60
		back	2.90	2.80
	II	sled	2.10	3.00
		back	2.70	4.50

J.

		Ration	Task sled	Task back
Phase	1	High	2.60	3.20
		Low	2.20	4.80
	2	High	2.10	2.40
		Low	2.40	2.50

K.

			Ration / Task: High sled	High back	Low sled	Low back
Cycle	I	Phase 1	2.40	3.80	1.00	4.60
		Phase 2	2.80	2.00	2.20	1.00
	II	Phase 1	2.80	2.60	3.40	5.00
		Phase 2	1.40	2.80	2.60	4.00

TABLE 56

LEVEL OF TALKATIVENESS IN TEAM IN THE PAST HOUR
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-1)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	3.2000	2.02	. .
Phases (t_2)	1	0.2000	<1	. .
Tasks (T)	1	3.2000	2.02	. .
Rations (R)	1	7.2000	4.55	.05
t_1t_2	1	0.2000	<1	. .
t_1T	1	0.8000	<1	. .
t_1R	1	0.2000	<1	. .
t_2T	1	7.2000	4.55	.05
t_2R	1	0.2000	<1	. .
TR	1	0.2000	<1	. .
t_1t_2T	1	7.2000	4.55	.05
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	3.2000	2.02	. .
t_2TR	1	5.0000	3.16	.10
t_1t_2TR	1	3.2000	2.02	. .
Residual	64	1.5812	. .	. .

TABLE 56--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	3.30	3.40	3.35
II	3.80	3.80	3.80
Avg.	3.55	3.58	3.57

B. Cycle × Task

Cycle	sled	back
I	3.70	3.10
II	3.90	3.70
Avg.	3.80	3.40

C. Cycle × Ration

Cycle	High	Low
I	3.65	3.15
II	4.15	3.45
Avg.	3.90	3.30

D. Phase × Task

Phase	sled	back
1	3.45	3.65
2	4.15	3.15

E. Phase × Ration

Phase	High	Low
1	3.90	3.20
2	3.90	3.40

F. Ration × Task

Ration	sled	back
High	4.15	3.65
Low	3.45	3.15

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	3.50	3.10
	Phase 2	3.80	3.20
II	Phase 1	4.30	3.30
	Phase 2	4.00	3.60

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	3.60	3.00
	Phase 2	3.80	3.20
II	Phase 1	3.30	4.30
	Phase 2	4.50	3.10

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.20	3.20
	back	3.10	3.10
II	sled	4.10	3.70
	back	4.20	3.20

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	3.60	4.20
	Low	3.30	3.10
2	High	4.70	3.10
	Low	3.60	3.20

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.00	3.00	3.20	3.00
	Phase 2	4.40	3.20	3.20	3.20
II	Phase 1	3.20	5.40	3.40	3.20
	Phase 2	5.00	3.00	4.00	3.20

TABLE 57

LEVEL OF ACCURACY OF THE STATEMENT THAT "THERE IS ALWAYS A LOT OF TALKING AND CONVERSATION IN THE TEAM" (QUESTIONNAIRE B, ITEM 7-3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.0000	4.21	.05
Phases (t_2)	1	0.0000	<1	. .
Tasks (T)	1	9.8000	8.25	.01
Rations (R)	1	4.0500	3.41	.10
t_1t_2	1	2.4500	2.06	. .
t_1T	1	2.4500	2.06	. .
t_1R	1	7.2000	6.06	.05
t_2T	1	0.4500	<1	. .
t_2R	1	1.8000	<1	. .
TR	1	0.2000	<1	. .
t_1t_2T	1	0.8000	<1	. .
t_1t_2R	1	4.0500	3.41	.10
t_1TR	1	1.2500	1.05	. .
t_2TR	1	1.2500	1.05	. .
t_1t_2TR	1	7.2000	6.06	.05
Residual	64	1.1875	. .	. .

TABLE 57--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	4.95	4.60	4.78
II	5.10	5.45	5.28
Avg.	5.02	5.02	5.02

B.

Cycle	Task: sled	Task: back
I	5.30	4.25
II	5.45	5.10
Avg.	5.38	4.68

C.

Cycle	Ration: High	Ration: Low
I	5.30	4.25
II	5.20	5.35
Avg.	5.25	4.80

D.

Phase	Task: sled	Task: back
1	5.30	4.75
2	5.45	4.60

E.

Phase	Ration: High	Ration: Low
1	5.10	4.95
2	5.40	4.65

F.

Ration	Task: sled	Task: back
High	5.65	4.85
Low	5.10	4.50

G.

Cycle		Ration: High	Ration: Low
I	Phase 1	5.10	4.80
	Phase 2	5.50	3.70
II	Phase 1	5.10	5.10
	Phase 2	5.30	5.60

H.

Cycle		Task: sled	Task: back
I	Phase 1	5.30	4.60
	Phase 2	5.30	3.90
II	Phase 1	5.30	4.90
	Phase 2	5.60	5.30

I.

Cycle	Task	Ration: High	Ration: Low
I	sled	6.00	4.60
	back	4.60	3.90
II	sled	5.30	5.60
	back	5.10	5.10

J.

Phase	Ration	Task: sled	Task: back
1	High	5.30	4.90
	Low	5.30	4.60
2	High	6.00	4.80
	Low	4.90	4.40

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	5.80	4.40	4.80	4.80
	Phase 2	6.20	4.80	4.40	3.00
II	Phase 1	4.80	5.40	5.80	4.40
	Phase 2	5.80	4.80	5.40	5.80

TABLE 58

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY GOOD LAUGHS
(NOON HOUR QUESTIONNAIRE [A], Item 6-8)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.2500	<1	. .
Phases (t_2)	1	1.8000	<1	. .
Tasks (T)	1	3.2000	1.30	. .
Rations (R)	1	22.0500	8.95	.01
t_1t_2	1	0.0500	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	7.2000	2.92	.10
t_2T	1	3.2000	1.30	. .
t_2R	1	0.0500	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	8.4500	3.43	.10
t_1t_2R	1	0.2000	<1	. .
t_1TR	1	7.2000	2.92	.10
t_2TR	1	2.4500	<1	. .
t_1t_2TR	1	12.8000	5.20	.05
Residual	64	2.4625	. .	. .

TABLE 58--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.00	2.75	2.88
II	3.30	2.95	3.12
Avg.	3.15	2.85	3.00

B.

Cycle	Task: sled	back
I	3.05	2.70
II	3.35	2.90
Avg.	3.20	2.80

C.

Cycle	Ration: High	Low
I	3.70	2.05
II	3.35	2.90
Avg.	3.52	2.48

D.

Phase	Task: sled	back
1	3.15	3.15
2	3.25	2.45

E.

Phase	Ration: High	Low
1	3.70	2.60
2	3.35	2.35

F.

Ration	Task: sled	back
High	3.65	3.40
Low	2.75	2.20

G.

Cycle		Ration: High	Low
I	Phase 1	3.90	2.10
	Phase 2	3.50	2.00
II	Phase 1	3.50	3.10
	Phase 2	3.20	2.70

H.

Cycle		Task: sled	back
I	Phase 1	3.30	2.70
	Phase 2	2.80	2.70
II	Phase 1	3.00	3.60
	Phase 2	3.70	2.20

I.

Cycle	Task	Ration: High	Low
I	sled	4.10	2.00
	back	3.30	2.10
II	sled	3.20	3.50
	back	3.50	2.30

J.

Phase	Ration	Task: sled	back
1	High	3.80	3.60
	Low	2.50	2.70
2	High	3.50	3.20
	Low	3.00	1.70

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	5.00	2.80	1.60	2.60
	Phase 2	3.20	3.80	2.40	1.60
II	Phase 1	2.60	4.40	3.40	2.80
	Phase 2	3.80	2.60	3.60	1.80

TABLE 59

LEVEL OF ACCURACY OF THE STATEMENT
THAT "WE DO A LOT OF BITCHING"
(QUESTIONNAIRE B, ITEM 7-11)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.5125	<1	. .
Phases (t_2)	1	0.0125	<1	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	21.0125	8.08	.01
t_1t_2	1	0.3125	<1	. .
t_1T	1	2.1125	<1	. .
t_1R	1	23.1125	8.89	.01
t_2T	1	3.6125	1.39	. .
t_2R	1	2.8125	1.08	. .
TR	1	2.8125	1.08	. .
t_1t_2T	1	17.1125	6.58	.05
t_1t_2R	1	1.0125	<1	. .
t_1TR	1	0.3125	<1	. .
t_2TR	1	3.6125	1.39	. .
t_1t_2TR	1	52.8125	20.31	.001
Residual	64	2.6000	. .	. .

TABLE 59—Continued

Mean Values

A. Cycle × Phase

	Phase 1	Phase 2	Avg.
Cycle I	4.05	3.90	3.98
Cycle II	3.65	3.75	3.70
Avg.	3.85	3.83	3.84

B. Cycle × Task

	Task sled	Task back
Cycle I	4.20	3.75
Cycle II	3.60	3.80
Avg.	3.90	3.78

C. Cycle × Ration

	Ration High	Ration Low
Cycle I	4.00	3.95
Cycle II	2.65	4.75
Avg.	3.33	4.35

D. Phase × Task

	Task sled	Task back
Phase 1	3.70	4.00
Phase 2	4.10	3.55

E. Phase × Ration

	Ration High	Ration Low
Phase 1	3.15	4.55
Phase 2	3.50	4.15

F. Ration × Task

	Task sled	Task back
Ration High	3.20	3.45
Ration Low	4.60	4.10

G.

Cycle		Ration High	Ration Low
I	Phase 1	4.00	4.10
	Phase 2	4.00	3.80
II	Phase 1	2.30	5.00
	Phase 2	3.00	4.50

H.

Cycle		Task sled	Task back
I	Phase 1	3.60	4.50
	Phase 2	4.80	3.00
II	Phase 1	3.80	3.50
	Phase 2	3.40	4.10

I.

Cycle	Task	Ration High	Ration Low
I	sled	4.10	4.30
	back	3.90	3.60
II	sled	2.30	5.00
	back	3.00	4.60

J.

Phase	Ration	Task sled	Task back
1	High	2.60	3.70
	Low	4.80	4.30
2	High	3.80	3.20
	Low	4.40	3.90

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	2.40	5.60	4.80	3.40
	Phase 2	5.80	2.20	3.80	3.80
II	Phase 1	2.80	1.80	4.80	5.20
	Phase 2	1.80	4.20	5.00	4.00

TABLE 60

LEVEL OF ANNOYANCE AND IRRITATION WITH SCIENTIFIC OBSERVERS IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-11)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	19.0125	12.62	.001
Phases (t_2)	1	0.6125	<1	. .
Tasks (T)	1	2.8125	1.87	. .
Rations (R)	1	1.0125	<1	. .
t_1t_2	1	0.1125	<1	. .
t_1T	1	0.3125	<1	. .
t_1R	1	23.1125	15.34	.001
t_2T	1	2.1125	1.40	. .
t_2R	1	1.5125	1.00	. .
TR	1	2.1125	1.40	. .
t_1t_2T	1	35.1125	23.31	.001
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	1.5125	1.00	. .
t_2TR	1	5.5125	3.66	.10
t_1t_2TR	1	30.0125	19.93	.001
Residual	64	1.5062	. .	. .

TABLE 60--Continued

Mean Values

A.

		Phase 1	Phase 2	Phase Avg.
Cycle	I	4.15	4.40	4.28
	II	3.25	3.35	3.30
	Avg.	3.70	3.88	3.79

B.

		Task sled	Task back
Cycle	I	4.15	4.40
	II	3.05	3.55
	Avg.	3.60	3.98

C.

		Ration High	Ration Low
Cycle	I	4.70	3.85
	II	2.65	3.95
	Avg.	3.68	3.90

D.

		Task sled	Task back
Phase	1	3.35	4.05
	2	3.85	3.90

E.

		Ration High	Ration Low
Phase	1	3.45	3.95
	2	3.90	3.85

F.

		Task sled	Task back
Ration	High	3.65	3.70
	Low	3.55	4.25

G.

			Ration High	Ration Low
Cycle	I	Phase 1	4.40	3.90
		Phase 2	5.00	3.80
	II	Phase 1	2.50	4.00
		Phase 2	2.80	3.90

H.

			Task sled	Task back
Cycle	I	Phase 1	3.20	5.10
		Phase 2	5.10	3.70
	II	Phase 1	3.50	3.00
		Phase 2	2.60	4.10

I.

		Task	Ration High	Ration Low
Cycle	I	sled	4.60	3.70
		back	4.80	4.00
	II	sled	2.70	3.40
		back	2.60	4.50

J.

		Ration	Task sled	Task back
Phase	1	High	3.00	3.90
		Low	3.70	4.20
	2	High	4.30	3.50
		Low	3.40	4.30

K.

			Ration / Task: High sled	High back	Low sled	Low back
Cycle	I	Phase 1	2.60	6.20	3.80	4.00
		Phase 2	6.60	3.40	3.60	4.00
	II	Phase 1	3.40	1.60	3.60	4.40
		Phase 2	2.00	3.60	3.20	4.60

TABLE 61

LEVEL OF ANNOYANCE AND IRRITATION WITH THE OTHER TEAMS IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-13)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	4.5125	1.75	. .
Phases (t_2)	1	1.5125	< 1	. .
Tasks (T)	1	2.1125	< 1	. .
Rations (R)	1	0.0125	< 1	. .
t_1t_2	1	12.0125	4.66	.05
t_1T	1	0.0125	< 1	. .
t_1R	1	17.1125	6.65	.05
t_2T	1	12.0125	4.66	.05
t_2R	1	0.0125	< 1	. .
TR	1	5.5125	2.14	. .
t_1t_2T	1	4.5125	1.75	. .
t_1t_2R	1	0.1125	< 1	. .
t_1TR	1	3.6125	1.40	. .
t_2TR	1	2.1125	< 1	. .
t_1t_2TR	1	1.0125	< 1	. .
Residual	64	2.5750	. .	. .

TABLE 61--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	4.75	3.70	4.22
II	3.50	4.00	3.75
Avg.	4.12	3.85	3.99

B. Cycle × Task

Cycle	Task sled	Task back
I	4.40	4.05
II	3.90	3.60
Avg.	4.15	3.82

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	4.70	3.75
II	3.30	4.20
Avg.	4.00	3.98

D. Phase × Task

Phase	Task sled	Task back
1	3.90	4.35
2	4.40	3.30

E. Phase × Ration

Phase	Ration High	Ration Low
1	4.15	4.10
2	3.85	3.85

F. Ration × Task

Ration	Task sled	Task back
High	3.90	4.10
Low	4.40	3.55

G.

Cycle		Ration High	Ration Low
I	Phase 1	5.20	4.30
	Phase 2	4.20	3.20
II	Phase 1	3.10	3.90
	Phase 2	3.50	4.50

H.

Cycle		Task sled	Task back
I	Phase 1	4.30	5.20
	Phase 2	4.50	2.90
II	Phase 1	3.50	3.50
	Phase 2	4.30	3.70

I.

Cycle	Task	Ration High	Ration Low
I	sled	4.40	4.40
	back	5.00	3.10
II	sled	3.40	4.40
	back	3.20	4.00

J.

Phase	Ration	Task sled	Task back
1	High	3.50	4.80
	Low	4.30	3.90
2	High	4.30	3.40
	Low	4.50	3.20

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.00	6.40	4.60	4.00
	Phase 2	4.80	3.60	4.20	2.20
II	Phase 1	3.00	3.20	4.00	3.80
	Phase 2	3.80	3.20	4.80	4.20

TABLE 62

LEVEL THAT "SETTLING ARGUMENTS" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-9)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.4500	< 1	. .
Phases (t_2)	1	0.2000	< 1	. .
Tasks (T)	1	7.2000	2.38	. .
Rations (R)	1	0.2000	< 1	. .
t_1t_2	1	7.2000	2.38	. .
t_1T	1	1.8000	< 1	. .
t_1R	1	9.8000	3.23	.10
t_2T	1	0.4500	< 1	. .
t_2R	1	0.0500	< 1	. .
TR	1	4.0500	1.34	. .
t_1t_2T	1	0.4500	< 1	. .
t_1t_2R	1	0.4500	< 1	. .
t_1TR	1	1.2500	< 1	. .
t_2TR	1	9.8000	3.23	.10
t_1t_2TR	1	0.2000	< 1	. .
Residual	64	3.0312	. .	. .

TABLE 62--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.75	3.25	3.50
II	3.00	3.70	3.35
Avg.	3.38	3.48	3.42

B.

Cycle	Task sled	Task back
I	3.65	3.35
II	3.80	2.90
Avg.	3.72	3.12

C.

Cycle	Ration High	Ration Low
I	3.20	3.80
II	3.75	2.95
Avg.	3.48	3.38

D.

Phase	Task sled	Task back
1	3.60	3.15
2	3.85	3.10

E.

Phase	Ration High	Ration Low
1	3.45	3.30
2	3.50	3.45

F.

Ration	Task sled	Task back
High	3.55	3.40
Low	3.90	2.85

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.40	4.10
	Phase 2	3.00	3.50
II	Phase 1	3.50	2.50
	Phase 2	4.00	3.40

H.

Cycle		Task sled	Task back
I	Phase 1	3.90	3.60
	Phase 2	3.40	3.10
II	Phase 1	3.30	2.70
	Phase 2	4.30	3.10

I.

Cycle	Task	Ration High	Ration Low
I	sled	3.00	4.30
	back	3.40	3.30
II	sled	4.10	3.50
	back	3.40	2.40

J.

Phase	Ration	Task sled	Task back
1	High	3.80	3.10
	Low	3.40	3.20
2	High	3.30	3.70
	Low	4.40	2.50

K.

Cycle		Ration / Task High sled	High back	Low sled	Low back
I	Phase 1	3.60	3.20	4.20	4.00
	Phase 2	2.40	3.60	4.40	2.60
II	Phase 1	4.00	3.00	2.60	2.40
	Phase 2	4.20	3.80	4.40	2.40

TABLE 63

LEVEL THAT "USING FIRST NAMES" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-2)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	4.0500	2.03	. .
Phases (t_2)	1	0.8000	< 1	. .
Tasks (T)	1	0.0500	< 1	. .
Rations (R)	1	5.0000	2.51	. .
t_1t_2	1	0.0000	< 1	. .
t_1T	1	0.0500	< 1	. .
t_1R	1	16.2000	8.13	.01
t_2T	1	5.0000	2.51	. .
t_2R	1	0.0500	< 1	. .
TR	1	0.0000	< 1	. .
t_1t_2T	1	9.8000	4.92	.05
t_1t_2R	1	0.0500	< 1	. .
t_1TR	1	0.8000	< 1	. .
t_2TR	1	26.4500	13.27	.001
t_1t_2TR	1	0.0500	< 1	. .
Residual	64	1.9938	. .	. .

TABLE 63--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	2.70	2.90	2.80
II	3.15	3.35	3.25
Avg.	2.92	3.12	3.02

B.

Cycle	Task: sled	Task: back
I	2.80	2.80
II	3.30	3.20
Avg.	3.05	3.00

C.

Cycle	Ration: High	Ration: Low
I	3.50	2.10
II	3.05	3.45
Avg.	3.28	2.78

D.

Phase	Task: sled	Task: back
1	3.20	2.65
2	2.90	3.35

E.

Phase	Ration: High	Ration: Low
1	3.15	2.70
2	3.40	2.85

F.

Ration	Task: sled	Task: back
High	3.30	3.25
Low	2.80	2.75

G.

Cycle		Ration: High	Ration: Low
I	Phase 1	3.40	2.00
	Phase 2	3.60	2.20
II	Phase 1	2.90	3.40
	Phase 2	3.20	3.50

H.

Cycle		Task: sled	Task: back
I	Phase 1	2.60	2.80
	Phase 2	3.00	2.80
II	Phase 1	3.80	2.50
	Phase 2	2.80	3.90

I.

Cycle	Task	Ration: High	Ration: Low
I	sled	3.40	2.20
	back	3.60	2.00
II	sled	3.20	3.40
	back	2.90	3.50

J.

Phase	Ration	Task: sled	Task: back
1	High	4.00	2.30
	Low	2.40	3.00
2	High	2.60	4.20
	Low	3.20	2.50

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	3.80	3.00	1.40	2.60
	Phase 2	3.00	4.20	3.00	1.40
II	Phase 1	4.20	1.60	3.40	3.40
	Phase 2	2.20	4.20	3.40	3.60

TABLE 64

LEVEL THAT "PRAISING EACH OTHER" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.5125	< 1	. .
Phases (t_2)	1	0.0125	< 1	. .
Tasks (T)	1	0.0125	< 1	. .
Rations (R)	1	4.5125	1.93	. .
t_1t_2	1	0.3125	< 1	. .
t_1T	1	2.8125	1.20	. .
t_1R	1	19.0125	8.11	.01
t_2T	1	0.0125	< 1	. .
t_2R	1	1.5125	< 1	. .
TR	1	6.6125	2.82	.10
t_1t_2T	1	1.5125	< 1	. .
t_1t_2R	1	1.5125	< 1	. .
t_1TR	1	1.5125	< 1	. .
t_2TR	1	5.5125	2.35	. .
t_1t_2TR	1	5.5125	2.35	. .
Residual	64	2.3438	. .	. .

TABLE 64--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	3.55	3.40	3.48
II	3.15	3.25	3.20
Avg.	3.35	3.32	3.34

B. Cycle × Task

Cycle	sled	back
I	3.65	3.30
II	3.00	3.40
Avg.	3.32	3.35

C. Cycle × Ration

Cycle	High	Low
I	4.20	2.75
II	2.95	3.45
Avg.	3.58	3.10

D. Phase × Task

Phase	sled	back
1	3.35	3.35
2	3.30	3.35

E. Phase × Ration

Phase	High	Low
1	3.45	3.25
2	3.70	2.95

F. Ration × Task

Ration	sled	back
High	3.85	3.30
Low	2.81	3.40

G. Cycle × Phase × Ration

Cycle	Phase	Ration High	Ration Low
I	Phase 1	4.00	3.10
	Phase 2	4.40	2.40
II	Phase 1	2.90	3.40
	Phase 2	3.00	3.50

H. Cycle × Phase × Task

Cycle	Phase	Task sled	Task back
I	Phase 1	3.60	3.50
	Phase 2	3.70	3.10
II	Phase 1	3.10	3.20
	Phase 2	3.90	3.60

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	4.80	2.50
	back	3.60	3.00
II	sled	2.90	3.10
	back	3.00	3.80

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	4.00	2.90
	Low	2.70	3.80
2	High	3.70	3.70
	Low	2.90	3.00

K. Ration / Task

Cycle	Phase	High sled	High back	Low sled	Low back
I	Phase 1	5.00	3.00	2.20	4.00
	Phase 2	4.60	4.20	2.80	2.00
II	Phase 1	3.00	2.80	3.20	3.60
	Phase 2	2.80	3.20	3.00	4.00

TABLE 65

LEVEL OF BEING AFFECTED IN THE PAST HOUR
BY GOOD FEELINGS TOWARD TEAMMATES
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-3)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	6.6125	4.56	.05
Phases (t_2)	1	5.5125	3.80	.10
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	0.6125	<1	. .
t_1t_2	1	0.6125	<1	. .
t_1T	1	0.3125	<1	. .
t_1R	1	17.1125	11.80	.01
t_2T	1	2.8125	1.94	. .
t_2R	1	2.1125	1.46	. .
TR	1	0.1125	<1	. .
t_1t_2T	1	0.0125	<1	. .
t_1t_2R	1	2.8125	1.94	. .
t_1TR	1	0.1125	<1	. .
t_2TR	1	15.3125	10.56	.01
t_1t_2TR	1	5.5125	3.80	.10
Residual	64	1.4500	. .	. .

TABLE 65—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	4.30	5.00	4.65
II	5.05	5.40	5.22
Avg.	4.68	5.20	4.94

B. Task

Cycle	sled	back
I	4.65	4.65
II	5.35	5.10
Avg.	5.00	4.88

C. Ration

Cycle	High	Low
I	5.20	4.10
II	4.85	5.60
Avg.	5.02	4.85

D. Task

Phase	sled	back
1	4.55	4.80
2	5.45	4.95

E. Ration

Phase	High	Low
1	4.60	4.75
2	5.45	4.95

F. Task

Ration	sled	back
High	5.05	5.00
Low	4.95	4.75

G. Ration

Cycle		High	Low
I	Phase 1	4.50	4.10
	Phase 2	5.90	4.10
II	Phase 1	4.70	5.40
	Phase 2	5.00	5.80

H. Task

Cycle		sled	back
I	Phase 1	4.10	4.50
	Phase 2	5.20	4.80
II	Phase 1	5.00	5.10
	Phase 2	5.70	5.10

I. Ration

Cycle	Task	High	Low
I	sled	5.20	4.10
	back	5.20	4.10
II	sled	4.90	5.80
	back	4.80	5.40

J. Task

Phase	Ration	sled	back
1	High	4.00	5.20
	Low	5.10	4.40
2	High	6.10	4.80
	Low	4.80	5.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.60	5.40	4.60	3.60
	Phase 2	6.80	5.00	3.60	4.60
II	Phase 1	4.40	5.00	5.60	5.20
	Phase 2	5.40	4.60	6.00	5.60

TABLE 66

LEVEL OF ACCURACY OF THE STATEMENT THAT "THERE IS PRETTY GOOD FEELING BETWEEN US HERE" (QUESTIONNAIRE B, ITEM 7-14)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0500	<1	. .
Phases (t_2)	1	0.0000	<1	. .
Tasks (T)	1	1.8000	1.20	. .
Rations (R)	1	0.4500	<1	. .
t_1t_2	1	0.8000	<1	. .
t_1T	1	0.8000	<1	. .
t_1R	1	42.0500	28.03	.001
t_2T	1	0.0500	<1	. .
t_2R	1	0.2000	<1	. .
TR	1	0.8000	<1	. .
t_1t_2T	1	0.0500	<1	. .
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.0000	<1	. .
t_2TR	1	0.4500	<1	. .
t_1t_2TR	1	2.4500	1.63	. .
Residual	64	1.5000	. .	. .

TABLE 66--Continued

Mean Values

A. Cycle by Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.25	5.45	5.35
II	5.50	5.30	5.40
Avg.	5.38	5.38	5.38

B. Cycle by Task

Cycle	Task: sled	back
I	5.30	5.40
II	5.15	5.65
Avg.	5.23	5.53

C. Cycle by Ration

Cycle	Ration: High	Low
I	6.15	4.55
II	4.75	6.05
Avg.	5.45	5.30

D. Phase by Task

Phase	Task: sled	back
1	5.25	4.40
2	5.20	5.55

E. Phase by Ration

Phase	Ration: High	Low
1	5.50	5.25
2	5.40	5.35

F. Ration by Task

Ration	Task: sled	back
High	5.20	5.70
Low	5.25	5.35

G.

Cycle		Ration: High	Low
I	Phase 1	6.20	4.30
	Phase 2	6.10	4.80
II	Phase 1	4.80	6.20
	Phase 2	4.70	5.90

H.

Cycle		Task: sled	back
I	Phase 1	5.20	5.30
	Phase 2	5.40	5.50
II	Phase 1	5.30	5.70
	Phase 2	5.00	5.60

I.

Cycle	Task	Ration: High	Low
I	sled	6.00	4.60
	back	6.30	4.50
II	sled	4.50	5.90
	back	5.10	6.20

J.

Phase	Ration	Task: sled	back
1	High	5.20	5.30
	Low	5.30	5.20
2	High	5.20	5.60
	Low	5.20	5.50

K. Ration / Task

Cycle		High: sled	High: back	Low: sled	Low: back
I	Phase 1	5.80	6.60	4.60	4.00
	Phase 2	6.20	6.00	4.60	5.00
II	Phase 1	4.60	5.00	6.00	6.40
	Phase 2	4.20	5.20	5.80	6.00

TABLE 67

LEVEL OF ACCURACY OF THE STATEMENT THAT "ALTHOUGH THE TEAM DOES ITS WORK ALL RIGHT, THERE'S NOT MUCH FRIENDLINESS HERE" (QUESTIONNAIRE B, ITEM 7-17)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.3125	<1	. .
Phases (t_2)	1	2.8125	1.25	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	2.8125	1.25	. .
t_1t_2	1	2.1125	<1	. .
t_1T	1	0.3125	<1	. .
t_1R	1	1.0125	<1	. .
t_2T	1	6.6125	2.93	.10
t_2R	1	1.5125	<1	. .
TR	1	2.1125	<1	. .
t_1t_2T	1	21.0125	9.31	.01
t_1t_2R	1	0.3125	<1	. .
t_1TR	1	3.6125	1.60	. .
t_2TR	1	2.1125	<1	. .
t_1t_2TR	1	0.0125	<1	. .
Residual	64	2.2562	. .	. .

TABLE 67--Continued

Mean Values

A. Cycle × Phase

		Phase 1	Phase 2	Avg.
Cycle	I	2.50	2.55	2.52
	II	2.30	3.00	2.65
	Avg.	2.40	2.78	2.59

B. Cycle × Task

		Task sled	back
Cycle	I	2.65	2.40
	II	2.65	2.65
	Avg.	2.65	2.52

C. Cycle × Ration

		Ration High	Low
Cycle	I	2.45	2.60
	II	2.35	2.95
	Avg.	2.40	2.78

D. Phase × Task

		Task sled	back
Phase	1	2.75	2.05
	2	2.55	3.00

E. Phase × Ration

		Ration High	Low
Phase	1	2.35	2.45
	2	2.45	3.10

F. Ration × Task

		Task sled	back
Ration	High	2.30	2.50
	Low	3.00	2.55

G.

			Ration High	Low
Cycle	I	Phase 1	2.50	2.50
		Phase 2	2.40	2.70
	II	Phase 1	2.20	2.40
		Phase 2	2.50	3.50

H.

			Task sled	back
Cycle	I	Phase 1	2.40	2.60
		Phase 2	2.90	2.20
	II	Phase 1	3.10	1.50
		Phase 2	2.20	3.80

I.

		Task	Ration High	Low
Cycle	I	sled	2.20	3.10
		back	2.70	2.10
	II	sled	2.40	2.90
		back	2.30	3.00

J.

		Ration	Task sled	back
Phase	1	High	2.70	2.00
		Low	2.80	2.10
	2	High	1.90	3.00
		Low	3.20	3.00

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	2.20	2.80	2.60	2.40
		Phase 2	2.20	2.60	3.60	1.80
	II	Phase 1	3.20	1.20	3.00	1.80
		Phase 2	1.60	3.40	2.80	4.20

TABLE 68

LEVEL THAT "STRICTNESS" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-1)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	3.2000	1.22	. .
Phases (t_2)	1	0.2000	< 1	. .
Tasks (T)	1	0.0500	< 1	. .
Rations (R)	1	0.0500	< 1	. .
t_1t_2	1	0.8000	< 1	. .
t_1T	1	0.0500	< 1	. .
t_1R	1	2.4500	< 1	. .
t_2T	1	6.0500	2.30	. .
t_2R	1	0.0500	< 1	. .
TR	1	0.8000	< 1	. .
t_1t_2T	1	2.4500	< 1	. .
t_1t_2R	1	0.4500	< 1	. .
t_1TR	1	5.0000	1.90	. .
t_2TR	1	9.8000	3.72	.10
t_1t_2TR	1	0.0000	< 1	. .
Residual	64	2.6312	. .	. .

TABLE 68--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	3.70	3.60	3.65
II	3.10	3.40	3.25
Avg.	3.40	3.50	3.45

B. Task

Cycle	sled	back
I	3.65	3.65
II	3.30	3.20
Avg.	3.48	3.42

C. Ration

Cycle	High	Low
I	3.45	3.85
II	3.40	3.10
Avg.	3.42	3.48

D. Task

Phase	sled	back
1	3.70	3.10
2	3.25	3.75

E. Ration

Phase	High	Low
1	3.35	3.45
2	3.50	3.50

F. Task

Ration	sled	back
High	3.35	3.50
Low	3.60	3.35

G. Ration

Cycle		High	Low
I	Phase 1	3.40	4.00
	Phase 2	3.50	3.70
II	Phase 1	3.30	2.90
	Phase 2	3.50	3.30

H. Task

Cycle		sled	back
I	Phase 1	3.80	3.60
	Phase 2	3.50	3.70
II	Phase 1	3.60	2.60
	Phase 2	3.00	3.80

I. Ration

Cycle	Task	High	Low
I	sled	3.60	3.70
	back	3.30	4.00
II	sled	3.10	3.50
	back	3.70	2.70

J. Task

Phase	Ration	sled	back
1	High	3.90	2.80
	Low	3.50	3.40
2	High	2.80	4.20
	Low	3.70	3.30

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.00	2.80	3.60	4.40
	Phase 2	3.20	3.80	3.80	3.60
II	Phase 1	3.80	2.80	3.40	2.40
	Phase 2	2.40	4.60	3.60	3.00

TABLE 69

LEVEL OF ACCURACY OF THE STATEMENT THAT "THIS WOULD BE A BETTER TEAM IF WE COULD ELIMINATE A FEW MEMBERS" (QUESTIONNAIRE B, ITEM 7-7)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.1125	<1	. .
Phases (t_2)	1	2.8125	1.01	. .
Tasks (T)	1	2.8125	1.01	. .
Rations (R)	1	4.5125	1.63	. .
t_1t_2	1	0.1125	<1	. .
t_1T	1	3.6125	1.30	. .
t_1R	1	3.6125	1.30	. .
t_2T	1	12.0125	4.33	.05
t_2R	1	0.3125	<1	. .
TR	1	0.6125	<1	. .
t_1t_2T	1	4.5125	1.63	. .
t_1t_2R	1	0.3125	<1	. .
t_1TR	1	1.5125	<1	. .
t_2TR	1	9.1125	3.28	.10
t_1t_2TR	1	0.3125	<1	. .
Residual	64	2.7750	. .	. .

TABLE 69--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	2.35	2.65	2.50
II	2.60	3.05	2.82
Avg.	2.48	2.85	2.66

B. Task

Cycle	sled	back
I	2.90	2.10
II	2.80	2.85
Avg.	2.85	2.48

C. Ration

Cycle	High	Low
I	2.05	2.95
II	2.80	2.85
Avg.	2.42	2.90

D. Task

Phase	sled	back
1	3.05	1.90
2	2.65	3.05

E. Ration

Phase	High	Low
1	2.30	2.65
2	2.55	3.15

F. Task

Ration	sled	back
High	2.70	2.15
Low	3.00	2.80

G. Ration

Cycle		High	Low
I	Phase 1	1.90	2.80
	Phase 2	2.70	2.50
II	Phase 1	2.20	3.10
	Phase 2	2.90	3.20

H. Task

Cycle		sled	back
I	Phase 1	2.90	1.80
	Phase 2	2.90	2.40
II	Phase 1	3.20	2.00
	Phase 2	2.40	3.70

I. Ration

Cycle	Task	High	Low
I	sled	2.40	3.40
	back	1.70	2.50
II	sled	3.00	2.60
	back	2.60	3.10

J. Task

Phase	Ration	sled	back
1	High	3.30	1.30
	Low	2.80	2.50
2	High	2.10	3.00
	Low	3.20	3.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	2.80	1.00	3.00	2.60
	Phase 2	2.00	2.40	3.80	2.40
II	Phase 1	3.80	1.60	2.60	2.40
	Phase 2	2.20	3.60	2.60	3.80

TABLE 70

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME OR ANOTHER OF THE GUYS IS ALWAYS RUBBING SOMEBODY THE WRONG WAY" (QUESTIONNAIRE B, ITEM 7-13)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.1125	<1	. .
Phases (t_2)	1	0.1125	<1	. .
Tasks (T)	1	6.6125	6.34	.05
Rations (R)	1	0.3125	<1	. .
t_1t_2	1	1.0125	<1	. .
t_1T	1	0.6125	<1	. .
t_1R	1	5.5125	5.28	.05
t_2T	1	2.1125	2.02	. .
t_2R	1	0.3125	<1	. .
TR	1	0.3125	<1	. .
t_1t_2T	1	4.5125	4.32	.05
t_1t_2R	1	0.3125	<1	. .
t_1TR	1	1.0125	<1	. .
t_2TR	1	17.1125	16.39	.001
t_1t_2TR	1	3.6125	3.46	. .10
Residual	64	1.0438	. .	. .

TABLE 70--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	2.40	2.25	2.32
II	2.10	2.40	2.25
Avg.	2.25	2.32	2.29

B. Cycle × Task

Cycle	Task sled	Task back
I	2.70	1.95
II	2.45	2.05
Avg.	2.58	2.00

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	2.00	2.65
II	2.45	2.05
Avg.	2.22	2.35

D. Phase × Task

Phase	Task sled	Task back
1	2.70	1.80
2	2.45	2.20

E. Phase × Ration

Phase	Ration High	Ration Low
1	2.25	2.25
2	2.20	2.45

F. Ration × Task

Ration	Task sled	Task back
High	2.45	2.00
Low	2.70	2.00

G.

Cycle		Ration High	Ration Low
I	Phase 1	2.20	2.60
	Phase 2	1.80	2.70
II	Phase 1	2.30	1.90
	Phase 2	2.60	2.20

H.

Cycle		Task sled	Task back
I	Phase 1	2.70	2.10
	Phase 2	2.70	1.80
II	Phase 1	2.70	1.50
	Phase 2	2.20	2.60

I.

Cycle	Task	Ration High	Ration Low
I	sled	2.20	3.20
	back	1.80	2.10
II	sled	2.70	2.20
	back	2.20	1.90

J.

Phase	Ration	Task sled	Task back
1	High	3.10	1.40
	Low	2.30	2.20
2	High	1.80	2.60
	Low	3.10	1.80

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	3.00	1.40	2.40	2.80
	Phase 2	1.40	2.20	4.00	1.40
II	Phase 1	3.20	1.40	2.20	1.60
	Phase 2	2.20	3.00	2.20	2.20

TABLE 71

LEVEL OF ACCURACY OF THE STATEMENT THAT "IT DOESN'T TAKE MUCH TO GET AN ARGUMENT STARTED IN THIS TEAM" (QUESTIONNAIRE B, ITEM 7-6)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	12.8000	7.97	.01
Phases (t_2)	1	1.2500	<1	. .
Tasks (T)	1	2.4500	1.53	. .
Rations (R)	1	7.2000	4.48	.05
t_1t_2	1	0.4500	<1	. .
t_1T	1	0.4500	<1	. .
t_1R	1	28.8000	17.93	.001
t_2T	1	16.2000	10.09	.01
t_2R	1	0.4500	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	0.2000	<1	. .
t_1t_2R	1	1.2500	<1	. .
t_1TR	1	0.4500	<1	. .
t_2TR	1	1.8000	1.12	. .
t_1t_2TR	1	0.2000	<1	. .
Residual	64	1.6062	. .	. .

TABLE 71--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	3.10	3.45	3.27
II	2.45	2.55	2.50
Avg.	2.78	3.00	2.89

B. Task

Cycle	sled	back
I	3.35	3.20
II	2.75	2.25
Avg.	3.05	2.72

C. Ration

Cycle	High	Low
I	2.40	4.15
II	2.80	2.20
Avg.	2.60	3.18

D. Task

Phase	sled	back
1	3.40	2.15
2	2.70	3.30

E. Ration

Phase	High	Low
1	2.55	3.00
2	2.65	3.35

F. Task

Ration	sled	back
High	2.85	2.35
Low	3.25	3.10

G. Ration

Cycle		High	Low
I	Phase 1	2.40	3.80
	Phase 2	2.40	4.50
II	Phase 1	2.70	2.20
	Phase 2	2.90	2.20

H. Task

Cycle		sled	back
I	Phase 1	3.70	2.50
	Phase 2	3.00	3.90
II	Phase 1	3.10	1.80
	Phase 2	2.40	2.70

I. Ration

Cycle	Task	High	Low
I	sled	2.50	4.20
	back	2.30	4.10
II	sled	3.20	2.30
	back	2.40	2.10

J. Task

Phase	Ration	sled	back
1	High	3.40	1.70
	Low	3.40	2.60
2	High	2.30	3.00
	Low	3.10	3.60

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.20	1.60	4.20	3.40
	Phase 2	1.80	3.00	4.20	4.80
II	Phase 1	3.60	1.80	2.60	1.80
	Phase 2	2.80	3.00	2.00	2.40

TABLE 72

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY ARGUMENTS
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-11)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.4500	2.56	. .
Phases (t_2)	1	0.0000	<1	. .
Tasks (T)	1	0.0500	<1	. .
Rations (R)	1	1.2500	1.31	. .
t_1t_2	1	0.0500	<1	. .
t_1T	1	0.2000	<1	. .
t_1R	1	0.0000	<1	. .
t_2T	1	2.4500	2.56	. .
t_2R	1	0.4500	<1	. .
TR	1	0.2000	<1	. .
t_1t_2T	1	7.2000	7.53	.01
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.4500	<1	. .
t_2TR	1	5.0000	5.23	.05
t_1t_2TR	1	1.2500	1.31	. .
Residual	64	0.9563	. .	. .

TABLE 72--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	1.55	1.60	1.58
II	1.95	1.90	1.92
Avg.	1.75	1.75	1.75

B. Cycle × Task

Cycle	Task sled	Task back
I	1.65	1.50
II	1.90	1.95
Avg.	1.78	1.72

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	1.45	1.70
II	1.80	2.05
Avg.	1.62	1.88

D. Phase × Task

Phase	Task sled	Task back
1	1.95	1.55
2	1.60	1.90

E. Phase × Ration

Phase	Ration High	Ration Low
1	1.70	1.80
2	1.55	1.95

F. Ration × Task

Ration	Task sled	Task back
High	1.60	1.55
Low	1.95	1.90

G. Cycle × Phase × Ration

Cycle	G.	Ration High	Ration Low
I	Phase 1	1.60	1.50
	Phase 2	1.30	1.80
II	Phase 1	1.80	2.10
	Phase 2	1.80	2.00

H. Cycle × Phase × Task

Cycle	H.	Task sled	Task back
I	Phase 1	1.50	1.60
	Phase 2	1.80	1.40
II	Phase 1	2.40	1.50
	Phase 2	1.40	2.40

I. Cycle × Task × Ration

Cycle	I. Task	Ration High	Ration Low
I	sled	1.40	1.80
	back	1.50	1.50
II	sled	1.80	2.00
	back	1.80	2.10

J. Phase × Ration × Task

Phase	J. Ration	Task sled	Task back
1	High	2.10	1.30
	Low	1.80	1.80
2	High	1.10	2.00
	Low	2.10	1.80

K. Cycle × Phase × Ration / Task

Cycle	K.	High sled	High back	Low sled	Low back
I	Phase 1	1.80	1.40	1.20	1.80
	Phase 2	1.00	1.60	2.60	1.20
II	Phase 1	2.40	1.20	2.40	1.80
	Phase 2	1.20	2.40	1.60	2.40

TABLE 73

LEVEL OF BEING AFFECTED IN THE PAST HOUR BY IRRITATION WITH TEAMMATES (NOON HOUR QUESTIONNAIRE [A], ITEM 6-7)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.3125	<1	. .
Phases (t_2)	1	0.0125	<1	. .
Tasks (T)	1	0.0125	<1	. .
Rations (R)	1	1.5125	1.15	. .
t_1t_2	1	1.0125	<1	. .
t_1T	1	1.5125	1.15	. .
t_1R	1	0.3125	<1	. .
t_2T	1	1.5125	1.15	. .
t_2R	1	2.8125	2.13	. .
TR	1	2.1125	1.60	. .
t_1t_2T	1	1.0125	<1	. .
t_1t_2R	1	0.6125	<1	. .
t_1TR	1	1.0125	<1	. .
t_2TR	1	19.0125	14.42	.001
t_1t_2TR	1	4.5125	3.42	.10
Residual	64	1.3188	. .	. .

TABLE 73--Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	2.25	2.50	2.38
	II	2.60	2.40	2.50
	Avg.	2.42	2.45	2.44

B. Task

		sled	back
Cycle	I	2.50	2.25
	II	2.35	2.65
	Avg.	2.42	2.45

C. Ration

		High	Low
Cycle	I	2.45	2.30
	II	2.70	2.30
	Avg.	2.58	2.30

D. Task

		sled	back
Phase	1	2.55	2.30
	2	2.30	2.60

E. Ration

		High	Low
Phase	1	2.75	2.10
	2	2.40	2.50

F. Task

		sled	back
Ration	High	2.40	2.75
	Low	2.45	2.15

G. Ration

			High	Low
Cycle	I	Phase 1	2.60	1.90
		Phase 2	2.30	2.70
	II	Phase 1	2.90	2.30
		Phase 2	2.50	2.30

H. Task

			sled	back
Cycle	I	Phase 1	2.40	2.10
		Phase 2	2.60	2.40
	II	Phase 1	2.70	2.50
		Phase 2	2.00	2.80

I. Ration

		Task	High	Low
Cycle	I	sled	2.30	2.70
		back	2.60	1.90
	II	sled	2.50	2.20
		back	2.90	2.40

J. Task

		Ration	sled	back
Phase	1	High	3.20	2.30
		Low	1.90	2.30
	2	High	1.60	3.20
		Low	3.00	2.00

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	3.20	2.00	1.60	2.20
		Phase 2	1.40	3.20	3.80	1.60
	II	Phase 1	3.20	2.60	2.20	2.40
		Phase 2	1.80	3.20	2.20	2.40

TABLE 74

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME PEOPLE IN THE TEAM ARE TOO SMART TO SAY WHAT THEY REALLY THINK" (QUESTIONNAIRE B, ITEM 7-1)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.0125	<1	. .
Phases (t_2)	1	0.6125	<1	. .
Tasks (T)	1	0.6125	<1	. .
Rations (R)	1	0.6125	<1	. .
t_1t_2	1	1.5125	<1	. .
t_1T	1	0.1125	<1	. .
t_1R	1	7.8125	3.42	.10
t_2T	1	1.0125	<1	. .
t_2R	1	1.5125	<1	. .
TR	1	0.0125	<1	. .
t_1t_2T	1	1.5125	<1	. .
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	1.0125	<1	. .
t_2TR	1	19.0125	8.31	.01
t_1t_2TR	1	0.0125	<1	. .
Residual	64	2.2875	. .	. .

TABLE 74--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.10	3.20	3.15
II	3.15	2.70	2.95
Avg.	3.12	2.95	3.04

B.

Cycle	Task sled	Task back
I	3.20	3.10
II	3.05	2.80
Avg.	3.12	2.95

C.

Cycle	Ration High	Ration Low
I	3.55	2.75
II	2.70	3.15
Avg.	3.12	2.95

D.

Phase	Task sled	Task back
1	3.10	3.15
2	3.15	2.75

E.

Phase	Ration High	Ration Low
1	3.35	2.90
2	2.90	3.00

F.

Ration	Task sled	Task back
High	3.20	3.05
Low	3.05	2.85

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.60	2.60
	Phase 2	3.10	3.20
II	Phase 1	3.50	2.90
	Phase 2	2.30	3.10

H.

Cycle		Task sled	Task back
I	Phase 1	2.90	3.30
	Phase 2	3.50	2.90
II	Phase 1	3.30	3.00
	Phase 2	2.80	2.60

I.

Cycle	Task	Ration High	Ration Low
I	sled	3.70	2.70
	back	3.40	2.80
II	sled	2.70	3.40
	back	2.70	2.90

J.

Phase	Ration	Task sled	Task back
1	High	3.80	2.90
	Low	2.40	3.40
2	High	2.60	3.20
	Low	3.70	2.30

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	4.00	3.20	1.80	3.40
	Phase 2	3.40	3.60	3.60	2.20
II	Phase 1	3.60	2.60	3.00	3.40
	Phase 2	1.80	2.80	3.80	2.40

TABLE 75

LEVEL OF ACCURACY OF THE STATEMENT THAT "THE TEAM AS A WHOLE MAKES IMPORTANT DECISIONS"
(QUESTIONNAIRE B, ITEM 7-8)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.4500	1.22	. .
Phases (t_2)	1	0.2000	<1	. .
Tasks (T)	1	0.0000	<1	. .
Rations (R)	1	0.2000	<1	. .
t_1t_2	1	2.4500	1.22	. .
t_1T	1	6.0500	3.02	.10
t_1R	1	14.4500	7.12	.01
t_2T	1	0.0000	<1	. .
t_2R	1	3.2000	1.60	. .
TR	1	1.8000	<1	. .
t_1t_2T	1	0.0500	<1	. .
t_1t_2R	1	0.0500	<1	. .
t_1TR	1	0.0500	<1	. .
t_2TR	1	0.8000	<1	. .
t_1t_2TR	1	4.0500	2.02	. .
Residual	64	2.0000	. .	. .

TABLE 75—Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.85	5.60	5.73
II	5.15	5.60	5.38
Avg.	5.50	5.60	5.55

B. Cycle × Task

Cycle	Task sled	Task back
I	5.45	6.00
II	5.62	5.10
Avg.	5.55	5.55

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	6.10	5.35
II	4.90	5.85
Avg.	5.50	5.60

D. Phase × Task

Phase	Task sled	Task back
1	5.50	5.50
2	5.60	5.60

E. Phase × Ration

Phase	Ration High	Ration Low
1	5.25	5.75
2	5.75	5.45

F. Ration × Task

Ration	Task sled	Task back
High	5.65	5.35
Low	5.45	5.75

G. Cycle × Phase × Ration

Cycle		Ration High	Ration Low
I	Phase 1	6.00	5.70
	Phase 2	6.20	5.00
II	Phase 1	4.50	5.80
	Phase 2	5.30	5.90

H. Cycle × Phase × Task

Cycle		Task sled	Task back
I	Phase 1	5.60	6.10
	Phase 2	5.30	5.90
II	Phase 1	5.40	4.90
	Phase 2	5.90	5.30

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	6.00	4.90
	back	6.20	5.80
II	sled	5.30	6.00
	back	4.50	5.70

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	5.30	5.20
	Low	5.70	5.80
2	High	6.00	4.50
	Low	5.20	5.70

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	5.60	6.40	5.60	5.80
	Phase 2	6.40	6.00	4.20	5.80
II	Phase 1	5.00	4.00	5.80	5.80
	Phase 2	5.60	5.00	6.20	5.60

TABLE 76

LEVEL THAT "ASKING INSTEAD OF ORDERING" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-5)

Analysis of Variance				
Source of Variation	**d. f.**	**Mean Square**	**F**	**Significance Level**
Cycles (t_1)	1	0.0500	< 1	. .
Phases (t_2)	1	0.2000	< 1	. .
Tasks (T)	1	1.8000	< 1	. .
Rations (R)	1	1.2500	< 1	. .
t_1t_2	1	0.2000	< 1	. .
t_1T	1	0.8000	< 1	. .
t_1R	1	2.4500	1.13	. .
t_2T	1	2.4500	1.13	. .
t_2R	1	1.8000	< 1	. .
TR	1	0.2000	< 1	. .
t_1t_2T	1	14.4500	6.66	.05
t_1t_2R	1	0.0000	< 1	. .
t_1TR	1	1.8000	< 1	. .
t_2TR	1	1.2500	< 1	. .
t_1t_2TR	1	4.0500	1.87	. .
Residual	64	2.1688	. .	. .

TABLE 76--Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	4.70	4.70	4.70
	II	4.75	4.55	4.65
	Avg.	4.72	4.62	4.68

B. Task

		sled	back
Cycle	I	4.65	4.75
	II	4.40	4.90
	Avg.	4.52	4.82

C. Ration

		High	Low
Cycle	I	4.75	4.65
	II	4.35	4.95
	Avg.	4.55	4.80

D. Task

		sled	back
Phase	1	4.25	5.05
	2	4.65	4.60

E. Ration

		High	Low
Phase	1	4.75	4.70
	2	4.35	4.90

F. Task

		sled	back
Ration	High	4.35	4.75
	Low	4.70	4.90

G. Ration

			High	Low
Cycle	I	Phase 1	4.90	4.50
		Phase 2	4.60	4.80
	II	Phase 1	4.60	4.90
		Phase 2	4.10	5.00

H. Task

			sled	back
Cycle	I	Phase 1	4.90	4.50
		Phase 2	4.40	5.00
	II	Phase 1	3.90	5.60
		Phase 2	4.90	4.20

I. Ration

		Task	High	Low
Cycle	I	sled	4.50	4.80
		back	5.00	4.50
	II	sled	4.20	4.60
		back	4.50	5.30

J. Task

		Ration	sled	back
Phase	1	High	4.50	5.00
		Low	4.30	5.10
	2	High	4.20	4.50
		Low	5.10	4.70

K. Ration / Task

			High		Low	
			sled	back	sled	back
Cycle	I	Phase 1	4.80	5.00	5.00	4.00
		Phase 2	4.20	5.00	4.60	5.00
	II	Phase 1	4.20	5.00	3.60	6.20
		Phase 2	4.20	4.00	5.60	4.40

TABLE 77

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME PEOPLE IN THE TEAM CAN PUSH THE OTHERS AROUND"
(QUESTIONNAIRE B, ITEM 7-4)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.4500	<1	. .
Phases (t_2)	1	3.2000	3.41	.10
Tasks (T)	1	5.0000	5.33	.05
Rations (R)	1	0.0500	<1	. .
t_1t_2	1	1.8000	1.92	. .
t_1T	1	3.2000	3.41	.10
t_1R	1	0.4500	<1	. .
t_2T	1	2.4500	2.61	. .
t_2R	1	1.8000	1.92	. .
TR	1	0.2000	<1	. .
t_1t_2T	1	8.4500	9.01	.01
t_1t_2R	1	0.2000	<1	. .
t_1TR	1	0.2000	<1	. .
t_2TR	1	11.2500	12.00	.001
t_1t_2TR	1	6.0500	6.45	.05
Residual	64	0.9375	. .	. .

TABLE 77—Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	1.85	2.55	2.20
II	2.00	2.10	2.05
Avg.	1.92	2.32	2.12

B. Cycle × Task

Cycle	sled	back
I	2.65	1.75
II	2.10	2.00
Avg.	2.38	1.88

C. Cycle × Ration

Cycle	High	Low
I	2.15	2.25
II	2.15	1.95
Avg	2.13	2.10

D. Phase × Task

Phase	sled	back
1	2.00	1.85
2	2.75	1.90

E. Phase × Ration

Phase	High	Low
1	2.10	1.75
2	2.20	2.45

F. Ration × Task

Ration	sled	back
High	2.35	1.95
Low	2.40	1.80

G. Cycle × Phase × Ration

Cycle	Phase	High	Low
I	Phase 1	2.00	1.70
	Phase 2	2.30	2.80
II	Phase 1	2.20	1.80
	Phase 2	2.10	2.10

H. Cycle × Phase × Task

Cycle	Phase	sled	back
I	Phase 1	1.80	1.90
	Phase 2	3.50	1.60
II	Phase 1	2.20	1.80
	Phase 2	2.00	2.20

I. Cycle × Task × Ration

Cycle	Task	High	Low
I	sled	2.60	2.70
	back	1.70	1.80
II	sled	2.10	2.10
	back	2.20	1.80

J. Phase × Ration × Task

Phase	Ration	sled	back
1	High	2.50	1.70
	Low	1.50	2.00
2	High	2.20	2.20
	Low	3.30	1.60

K. Cycle × Phase × Ration / Task

Cycle	Phase	High sled	High back	Low sled	Low back
I	Phase 1	2.60	1.40	1.00	2.40
	Phase 2	2.60	2.00	4.40	1.20
II	Phase 1	2.40	2.00	2.00	1.60
	Phase 2	1.80	2.40	2.20	2.00

TABLE 78

LEVEL THAT "PLAYING FAVORITES" HOLDS IN THE TEAM
(QUESTIONNAIRE C, ITEM 3-8)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.1125	< 1	. .
Phases (t_2)	1	0.0125	< 1	. .
Tasks (T)	1	0.6125	< 1	. .
Rations (R)	1	5.5125	1.94	. .
t_1t_2	1	5.5125	1.94	. .
t_1T	1	0.0125	< 1	. .
t_1R	1	0.1125	< 1	. .
t_2T	1	1.5125	< 1	. .
t_2R	1	0.0125	< 1	. .
TR	1	0.0125	< 1	. .
t_1t_2T	1	6.6125	2.33	. .
t_1t_2R	1	0.3125	< 1	. .
t_1TR	1	0.6125	< 1	. .
t_2TR	1	10.5125	3.70	.10
t_1t_2TR	1	1.0125	< 1	. .
Residual	64	2.8438	. .	. .

TABLE 78--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.20	2.65	2.92
II	2.35	2.85	2.60
Avg.	2.78	2.75	2.76

B.

Cycle	Task sled	Task back
I	2.85	3.00
II	2.50	2.70
Avg.	2.68	2.85

C.

Cycle	Ration High	Ration Low
I	3.15	2.70
II	2.90	2.30
Avg.	3.02	2.50

D.

Phase	Task sled	Task back
1	2.55	3.00
2	2.80	2.70

E.

Phase	Ration High	Ration Low
1	3.05	2.50
2	3.00	2.50

F.

Ration	Task sled	Task back
High	2.75	3.10
Low	2.40	2.60

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.50	2.90
	Phase 2	2.80	2.50
II	Phase 1	2.60	2.10
	Phase 2	3.20	2.50

H.

Cycle		Task sled	Task back
I	Phase 1	2.70	3.70
	Phase 2	3.00	2.30
II	Phase 1	2.40	2.30
	Phase 2	2.60	3.10

I.

Cycle	Task	Ration High	Ration Low
I	sled	3.00	2.70
	back	3.30	0.70
II	sled	2.90	2.10
	back	2.90	2.50

J.

Phase	Ration	Task sled	Task back
1	High	3.20	2.90
	Low	1.90	3.10
2	High	2.70	3.30
	Low	2.90	2.10

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	3.40	3.60	2.00	3.80
	Phase 2	2.60	3.00	3.40	1.60
II	Phase 1	3.00	2.20	1.80	2.40
	Phase 2	2.80	3.60	2.40	2.60

TABLE 79

LEVEL OF BEING AFFECTED IN THE PAST HOUR
BY RESPECT FOR TEAMMATES
(NOON HOUR QUESTIONNAIRE [A], ITEM 6-10)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.6125	<1	. .
Phases (t_2)	1	0.6125	<1	. .
Tasks (T)	1	0.0125	<1	. .
Rations (R)	1	1.0125	<1	. .
t_1t_2	1	0.3125	<1	. .
t_1T	1	2.8125	1.55	. .
t_1R	1	9.1125	5.03	.05
t_2T	1	0.6125	<1	. .
t_2R	1	1.0125	<1	. .
TR	1	0.3125	<1	. .
t_1t_2T	1	0.3125	<1	. .
t_1t_2R	1	0.0125	<1	. .
t_1TR	1	0.0125	<1	. .
t_2TR	1	2.1125	1.17	. .
t_1t_2TR	1	0.3125	<1	. .
Residual	64	1.8125	. .	. .

TABLE 79--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	5.20	5.25	5.22
II	5.25	5.55	5.40
Avg.	5.22	5.40	5.31

B.

Cycle	Task: sled	Task: back
I	5.05	5.40
II	5.60	5.20
Avg.	5.32	5.30

C.

Cycle	Ration: High	Ration: Low
I	5.45	5.00
II	4.95	5.85
Avg.	5.20	5.42

D.

Phase	Task: sled	Task: back
1	5.15	5.30
2	5.50	5.30

E.

Phase	Ration: High	Ration: Low
1	5.00	5.45
2	5.40	5.40

F.

Ration	Task: sled	Task: back
High	5.15	5.25
Low	5.50	5.35

G.

Cycle		Ration: High	Ration: Low
I	Phase 1	5.30	5.10
	Phase 2	5.60	4.90
II	Phase 1	4.70	5.80
	Phase 2	5.20	5.90

H.

Cycle		Task: sled	Task: back
I	Phase 1	5.00	5.40
	Phase 2	5.10	5.40
II	Phase 1	5.30	5.20
	Phase 2	5.90	5.20

I.

Cycle	Task	Ration: High	Ration: Low
I	sled	5.20	4.90
	back	5.70	5.10
II	sled	5.10	6.10
	back	4.80	5.60

J.

Phase	Ration	Task: sled	Task: back
1	High	4.70	5.30
	Low	5.60	5.30
2	High	5.60	5.20
	Low	5.40	5.40

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	4.80	5.80	5.20	5.00
	Phase 2	5.60	5.60	4.60	5.20
II	Phase 1	4.60	4.80	6.00	5.60
	Phase 2	5.60	4.80	6.20	5.60

TABLE 80

LEVEL OF ACCURACY OF THE STATEMENT THAT "THE TEAM NEEDS FEWER CHIEFS AND MORE INDIANS" (QUESTIONNAIRE B, ITEM 7-16)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.6125	<1	. .
Phases (t_2)	1	1.0125	<1	. .
Tasks (T)	1	2.1125	<1	. .
Rations (R)	1	0.3125	<1	. .
t_1t_2	1	0.3125	<1	. .
t_1T	1	0.6125	<1	. .
t_1R	1	4.5125	1.77	. .
t_2T	1	2.8125	1.10	. .
t_2R	1	0.0125	<1	. .
TR	1	3.6125	1.42	. .
t_1t_2T	1	10.5125	4.12	.05
t_1t_2R	1	0.0125	<1	. .
t_1TR	1	1.0125	<1	. .
t_2TR	1	10.5125	4.12	.05
t_1t_2TR	1	4.5125	1.77	. .
Residual	64	2.5500	. .	. .

TABLE 80--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	2.30	2.40	2.35
II	2.35	2.70	2.52
Avg.	2.32	2.55	2.44

B. Cycle × Task

Cycle	sled	back
I	2.60	2.10
II	2.60	2.45
Avg.	2.60	2.28

C. Cycle × Ration

Cycle	High	Low
I	2.05	2.65
II	2.70	2.35
Avg.	2.38	2.50

D. Phase × Task

Phase	sled	back
1	2.30	2.35
2	2.90	2.20

E. Phase × Ration

Phase	High	Low
1	2.25	2.40
2	2.50	2.60

F. Ration × Task

Ration	sled	back
High	2.75	2.00
Low	2.45	2.55

G. Cycle × Phase × Ration

Cycle	Phase	High	Low
I	Phase 1	2.00	2.60
	Phase 2	2.10	2.70
II	Phase 1	2.50	2.20
	Phase 2	2.90	2.50

H. Cycle × Phase × Task

Cycle	Phase	sled	back
I	Phase 1	2.00	2.60
	Phase 2	3.20	1.60
II	Phase 1	2.60	2.10
	Phase 2	2.60	2.80

I. Cycle × Task × Ration

Cycle	Task	High	Low
I	sled	2.40	2.80
	back	1.70	2.50
II	sled	3.10	2.10
	back	2.30	2.60

J. Phase × Ration × Task

Phase	Ration	sled	back
1	High	2.80	1.70
	Low	1.80	3.00
2	High	2.70	2.30
	Low	3.10	2.10

K. Cycle × Phase × Ration / Task

Cycle	Phase	High sled	High back	Low sled	Low back
I	Phase 1	2.40	1.60	1.60	3.60
	Phase 2	2.40	1.80	4.00	1.40
II	Phase 1	3.20	1.80	2.00	2.40
	Phase 2	3.00	2.80	2.20	2.80

TABLE 81

LEVEL OF ACCURACY OF THE STATEMENT THAT "NOT EVERYONE HAS A CLEAR IDEA OF WHAT HE IS SUPPOSED TO BE DOING" (QUESTIONNAIRE B, ITEM 7-19)

Analysis of Variance				
Source of Variation	**d. f.**	**Mean Square**	**F**	**Significance Level**
Cycles (t_1)	1	0.8000	<1	. .
Phases (t_2)	1	0.8000	<1	. .
Tasks (T)	1	0.4500	<1	. .
Rations (R)	1	12.8000	4.77	.05
t_1t_2	1	1.8000	<1	. .
t_1T	1	0.4500	<1	. .
t_1R	1	24.2000	9.03	.01
t_2T	1	0.4500	<1	. .
t_2R	1	0.8000	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	18.0500	6.73	.05
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.0500	<1	. .
t_2TR	1	6.0500	2.26	. .
t_1t_2TR	1	0.4500	<1	. .
Residual	64	2.6812	. .	. .

TABLE 81—Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.15	2.65	2.90
II	3.05	3.15	3.10
Avg.	3.10	2.90	3.00

B.

Cycle	Task sled	Task back
I	2.75	3.05
II	3.10	3.10
Avg.	2.92	3.08

C.

Cycle	Ration High	Ration Low
I	3.05	2.75
II	2.15	4.05
Avg.	2.60	3.40

D.

Phase	Task sled	Task back
1	3.10	3.10
2	2.75	3.05

E.

Phase	Ration High	Ration Low
1	2.80	3.40
2	2.40	3.40

F.

Ration	Task sled	Task back
High	2.45	2.75
Low	3.40	3.40

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.30	3.00
	Phase 2	2.80	2.50
II	Phase 1	2.30	3.80
	Phase 2	2.00	4.30

H.

Cycle		Task sled	Task back
I	Phase 1	2.60	3.70
	Phase 2	2.90	2.40
II	Phase 1	3.60	2.50
	Phase 2	2.60	3.70

I.

Cycle	Task	Ration High	Ration Low
I	sled	2.80	2.70
	back	3.30	2.80
II	sled	2.10	4.10
	back	2.20	4.00

J.

Phase	Ration	Task sled	Task back
1	High	3.00	2.60
	Low	3.20	3.60
2	High	1.90	2.90
	Low	3.60	3.20

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	3.00	3.60	2.20	3.80
	Phase 2	2.60	3.00	3.20	1.80
II	Phase 1	3.00	1.60	4.20	3.40
	Phase 2	1.20	2.80	4.00	4.60

TABLE 82

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME MEMBERS OF THE TEAM DON'T REALLY KNOW WHAT THEY ARE HERE FOR" (QUESTIONNAIRE B, ITEM 7-15)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0125	<1	. .
Phases (t_2)	1	0.1125	<1	. .
Tasks (T)	1	2.8125	<1	. .
Rations (R)	1	2.8125	<1	. .
t_1t_2	1	2.8125	<1	. .
t_1T	1	0.3125	<1	. .
t_1R	1	21.0125	5.79	.05
t_2T	1	5.5125	1.52	. .
t_2R	1	0.0125	<1	. .
TR	1	2.1125	<1	. .
t_1t_2T	1	1.0125	<1	. .
t_1t_2R	1	0.0125	<1	. .
t_1TR	1	4.5125	1.24	. .
t_2TR	1	0.0125	<1	. .
t_1t_2TR	1	0.0125	<1	. .
Residual	64	3.6312	. .	. .

TABLE 82—Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.35	2.90	3.13
II	3.00	3.30	3.15
Avg.	3.18	3.10	3.14

B.

Cycle	Task sled	Task back
I	3.25	3.00
II	3.40	2.90
Avg.	3.33	2.95

C.

Cycle	Ration High	Ration Low
I	3.45	2.80
II	2.45	3.85
Avg.	2.95	3.33

D.

Phase	Task sled	Task back
1	3.10	3.25
2	3.55	2.65

E.

Phase	Ration High	Ration Low
1	3.00	3.35
2	2.90	3.30

F.

Ration	Task sled	Task back
High	3.30	2.60
Low	3.35	3.30

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.70	3.00
	Phase 2	3.20	2.60
II	Phase 1	2.30	3.70
	Phase 2	2.60	4.00

H.

Cycle		Task sled	Task back
I	Phase 1	3.10	3.60
	Phase 2	3.50	2.40
II	Phase 1	3.10	2.90
	Phase 2	3.70	2.90

I.

Cycle	Task	Ration High	Ration Low
I	sled	3.50	3.00
	back	3.40	2.60
II	sled	3.10	3.70
	back	1.80	4.00

J.

Phase	Ration	Task sled	Task back
1	High	3.10	2.90
	Low	3.10	3.60
2	High	3.50	2.30
	Low	3.60	3.00

K.

Cycle		Ration / Task High sled	High back	Low sled	Low back
I	Phase 1	3.40	4.00	2.80	3.20
	Phase 2	3.60	2.80	3.20	2.00
II	Phase 1	2.80	1.80	3.40	4.00
	Phase 2	3.40	1.80	4.00	4.00

TABLE 83

SUBJECT ESTIMATION OF OWN TEAM'S PERFORMANCE DURING PHASE
(QUESTIONNAIRE B, ITEM 1)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0500	<1	. .
Phases (t_2)	1	0.4500	<1	. .
Tasks (T)	1	0.8000	<1	. .
Rations (R)	1	0.0500	<1	. .
t_1t_2	1	0.8000	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	3.2000	3.48	.10
t_2T	1	0.0500	<1	. .
t_2R	1	0.8000	<1	. .
TR	1	0.4500	<1	. .
t_1t_2T	1	3.2000	3.48	.10
t_1t_2R	1	1.2500	1.36	. .
t_1TR	1	0.8000	<1	. .
t_2TR	1	0.2000	<1	. .
t_1t_2TR	1	0.0500	<1	. .
Residual	64	0.9188	. .	. .

TABLE 83—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	5.80	5.75	5.78
II	5.55	5.90	5.72
Avg.	5.68	5.82	5.75

B. Task

Cycle	sled	back
I	5.70	5.85
II	5.60	5.85
Avg.	5.65	5.85

C. Ration

Cycle	High	Low
I	6.00	5.55
II	5.55	5.90
Avg.	5.78	5.72

D. Task

Phase	sled	back
1	5.55	5.80
2	5.75	5.90

E. Ration

Phase	High	Low
1	5.80	5.55
2	5.75	5.90

F. Task

Ration	sled	back
High	5.75	5.80
Low	5.55	5.90

G. Ration

Cycle		High	Low
I	Phase 1	6.00	5.60
	Phase 2	6.00	5.50
II	Phase 1	5.60	5.50
	Phase 2	5.50	6.30

H. Task

Cycle		sled	back
I	Phase 1	5.90	5.70
	Phase 2	5.50	6.00
II	Phase 1	5.20	5.90
	Phase 2	6.00	5.80

I. Ration

Cycle	Task	High	Low
I	sled	5.90	5.50
	back	6.10	5.60
II	sled	5.60	5.60
	back	5.50	6.20

J. Task

Phase	Ration	sled	back
1	High	5.70	5.90
	Low	5.40	5.70
2	High	5.80	5.70
	Low	5.70	6.10

K. Ration / Task

		High		Low	
Cycle		sled	back	sled	back
I	Phase 1	6.00	6.00	5.80	5.40
	Phase 2	5.80	6.20	5.20	5.80
II	Phase 1	5.40	5.80	5.00	6.00
	Phase 2	5.80	5.20	6.20	6.40

TABLE 84

SUBJECT SATISFACTION WITH BEING WITH PRESENT TEAM
(QUESTIONNAIRE B, ITEM 3)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	1.0125	<1	. .
Phases (t_2)	1	0.6125	<1	. .
Tasks (T)	1	2.1125	2.01	. .
Rations (R)	1	3.6125	3.44	.10
t_1t_2	1	2.8125	2.67	. .
t_1T	1	1.0125	<1	. .
t_1R	1	7.1125	16.30	.001
t_2T	1	2.8125	2.68	. .
t_2R	1	0.6125	<1	. .
TR	1	3.6125	3.44	.10
t_1t_2T	1	0.6125	<1	. .
t_1t_2R	1	2.8125	2.67	. .
t_1TR	1	0.3125	<1	. .
t_2TR	1	1.0125	<1	. .
t_1t_2TR	1	0.6125	<1	. .
Residual	64	1.0500	. .	. .

TABLE 84—Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.15	5.70	5.42
II	5.75	5.55	5.65
Avg.	5.45	5.80	5.54

B. Cycle × Task

Cycle	sled	back
I	5.15	5.70
II	5.60	5.70
Avg.	5.38	5.70

C. Cycle × Ration

Cycle	High	Low
I	6.10	4.75
II	5.40	5.90
Avg.	5.75	5.32

D. Phase × Task

Phase	sled	back
1	5.10	5.80
2	5.65	5.60

E. Phase × Ration

Phase	High	Low
1	5.75	5.15
2	5.80	5.50

F. Ration × Task

Ration	sled	back
High	5.80	5.70
Low	4.95	5.70

G. Cycle × Phase × Ration

Cycle	Phase	Ration High	Ration Low
I	Phase 1	6.10	4.20
	Phase 2	6.10	5.30
II	Phase 1	5.40	6.10
	Phase 2	5.40	5.70

H. Cycle × Phase × Task

Cycle	Phase	Task sled	Task back
I	Phase 1	4.60	5.70
	Phase 2	5.70	5.70
II	Phase 1	5.60	5.90
	Phase 2	5.68	5.50

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	6.10	4.20
	back	6.10	5.30
II	sled	5.50	5.70
	back	5.30	6.10

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	5.50	6.00
	Low	4.70	5.60
2	High	6.10	5.40
	Low	5.20	5.80

K. Cycle × Phase × Ration / Task

Cycle	Phase	High sled	High back	Low sled	Low back
I	Phase 1	5.80	6.40	3.40	5.00
	Phase 2	6.40	5.80	5.00	5.60
II	Phase 1	5.20	5.60	6.00	6.20
	Phase 2	5.80	5.00	5.40	6.00

TABLE 85

LEVEL OF ACCURACY OF THE STATEMENT THAT "EVERYBODY ALWAYS PULLS TOGETHER TO GET A JOB DONE" (QUESTIONNAIRE, ITEM 7-5)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.4500	1.85	. .
Phases (t_2)	1	0.4500	<1	. .
Tasks (T)	1	0.2000	<1	. .
Rations (R)	1	0.8000	<1	. .
t_1t_2	1	0.0000	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	14.4500	10.91	.01
t_2T	1	0.0500	<1	. .
t_2R	1	0.4500	<1	. .
TR	1	0.0000	<1	. .
t_1t_2T	1	0.0000	<1	. .
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.0500	<1	. .
t_2TR	1	1.2500	<1	. .
t_1t_2TR	1	5.0000	3.77	.10
Residual	64	1.3250	. .	. .

TABLE 85—Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	6.05	5.90	5.98
	II	5.70	5.55	5.62
	Avg.	5.88	5.72	5.80

B. Task

		sled	back
Cycle	I	5.95	6.00
	II	5.55	5.70
	Avg.	5.75	5.85

C. Ration

		High	Low
Cycle	I	6.30	5.65
	II	5.10	6.15
	Avg.	5.70	5.90

D. Task

		sled	back
Phase	1	5.80	5.95
	2	5.70	5.75

E. Ration

		High	Low
Phase	1	5.70	6.05
	2	5.70	5.75

F. Task

		sled	back
Ration	High	5.65	5.75
	Low	5.85	5.95

G. Ration

			High	Low
Cycle	I	Phase 1	6.40	5.70
		Phase 2	6.20	5.60
	II	Phase 1	5.00	6.40
		Phase 2	5.20	5.90

H. Task

			sled	back
Cycle	I	Phase 1	6.00	6.10
		Phase 2	5.90	5.90
	II	Phase 1	5.60	5.80
		Phase 2	5.50	5.60

I. Ration

		Task	High	Low
Cycle	I	sled	6.30	5.60
		back	6.30	5.70
	II	sled	5.00	6.10
		back	5.20	6.20

J. Task

		Ration	sled	back
Phase	1	High	5.50	5.90
		Low	6.10	6.00
	2	High	5.80	5.60
		Low	5.60	5.90

K. Ration / Task

			High sled	High back	Low sled	Low back
Cycle	I	Phase 1	6.00	6.80	6.00	5.40
		Phase 2	6.60	5.80	5.20	6.00
	II	Phase 1	5.00	5.00	6.20	6.60
		Phase 2	5.00	5.40	6.00	5.80

TABLE 86

LEVEL OF ACCURACY OF THE STATEMENT THAT "MEMBERS OF THE TEAM WORK WELL TOGETHER AS A GROUP" (QUESTIONNAIRE B, ITEM 7-10)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.3125	<1	. .
Phases (t_2)	1	0.1125	<1	. .
Tasks (T)	1	0.1125	<1	. .
Rations (R)	1	1.0125	1.00	. .
t_1t_2	1	0.1125	<1	. .
t_1T	1	1.0125	1.00	. .
t_1R	1	21.0125	20.75	.001
t_2T	1	1.0125	1.00	. .
t_2R	1	0.6125	<1	. .
TR	1	0.3125	<1	. .
t_1t_2T	1	0.0125	<1	. .
t_1t_2R	1	0.1125	<1	. .
t_1TR	1	0.1125	<1	. .
t_2TR	1	2.1125	2.09	. .
t_1t_2TR	1	0.6125	<1	. .
Residual	64	1.0125	. .	. .

TABLE 86—Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.85	5.85	5.85
II	5.65	5.80	5.72
Avg.	5.75	5.82	5.78

B. Cycle × Task

Cycle	sled	back
I	5.70	6.00
II	5.80	5.65
Avg.	5.75	5.83

C. Cycle × Ration

Cycle	High	Low
I	6.25	5.45
II	5.10	6.35
Avg.	5.68	5.90

D. Phase × Task

Phase	sled	back
1	5.60	5.90
2	5.90	5.25

E. Phase × Ration

Phase	High	Low
1	5.55	5.95
2	5.80	5.85

F. Ration × Task

Ration	sled	back
High	5.70	5.65
Low	5.80	6.00

G. Cycle × Phase × Ration

Cycle		High	Low
I	Phase 1	6.20	5.50
	Phase 2	6.30	5.40
II	Phase 1	4.90	6.40
	Phase 2	5.30	6.30

H. Cycle × Phase × Task

Cycle		sled	back
I	Phase 1	5.60	6.10
	Phase 2	5.80	5.90
II	Phase 1	5.60	5.70
	Phase 2	6.00	5.60

I. Cycle × Task × Ration

Cycle	Task	High	Low
I	sled	6.20	5.20
	back	6.30	5.70
II	sled	5.20	6.40
	back	5.00	6.30

J. Phase × Ration × Task

Phase	Ration	sled	back
1	High	5.30	5.80
	Low	5.90	6.00
2	High	6.10	5.80
	Low	5.70	6.00

K. Cycle × Phase × Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	5.80	6.60	5.40	5.60
	Phase 2	6.60	6.00	5.00	5.80
II	Phase 1	4.80	5.00	6.40	6.40
	Phase 2	5.60	5.00	6.40	6.20

TABLE 87

LEVEL THAT "HELPING EACH OTHER" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-10)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.5125	2.83	.10
Phases (t_2)	1	2.1125	1.08	. .
Tasks (T)	1	1.0125	< 1	. .
Rations (R)	1	0.0125	< 1	. .
t_1t_2	1	6.6125	3.39	.10
t_1T	1	4.5125	2.31	. .
t_1R	1	17.1125	8.78	.01
t_2T	1	2.1125	1.08	. .
t_2R	1	0.6125	< 1	. .
TR	1	0.6125	< 1	. .
t_1t_2T	1	3.6125	1.85	. .
t_1t_2R	1	0.3125	< 1	. .
t_1TR	1	0.3125	< 1	. .
t_2TR	1	0.6125	< 1	. .
t_1t_2TR	1	2.1125	1.08	. .
Residual	64	1.9500	. .	. .

TABLE 87—Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	4.40	5.30	4.85
II	5.50	5.25	5.38
Avg.	4.95	5.28	5.11

B. Task

Cycle	sled	back
I	5.20	4.50
II	5.25	5.50
Avg.	5.22	5.00

C. Ration

Cycle	High	Low
I	5.30	4.40
II	4.90	5.85
Avg.	5.10	5.62

D. Task

Phase	sled	back
1	4.90	5.00
2	5.55	5.00

E. Ration

Phase	High	Low
1	4.85	5.05
2	5.35	5.20

F. Task

Ration	sled	back
High	5.30	4.90
Low	5.15	5.10

G. Ration

Cycle		High	Low
I	Phase 1	4.70	4.10
	Phase 2	5.90	4.70
II	Phase 1	5.00	6.00
	Phase 2	4.80	5.70

H. Task

Cycle		sled	back
I	Phase 1	4.80	4.00
	Phase 2	5.60	5.00
II	Phase 1	5.00	6.00
	Phase 2	5.50	5.00

I. Ration

Cycle	Task	High	Low
I	sled	5.80	4.60
	back	4.80	4.20
II	sled	4.80	5.70
	back	5.00	6.00

J. Task

Phase	Ration	sled	back
1	High	4.80	4.80
	Low	5.00	5.10
2	High	5.80	4.80
	Low	5.30	5.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	5.00	4.40	4.60	3.60
	Phase 2	6.60	5.20	4.60	4.80
II	Phase 1	4.60	5.40	5.40	6.60
	Phase 2	5.00	4.60	6.00	5.40

TABLE 88

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOMEBODY IN THE TEAM IS WILLING TO GIVE ME A HAND, EVEN WITHOUT MY ASKING" (QUESTIONNAIRE B, ITEM 7-2)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.0500	<1	. .
Phases (t_2)	1	0.8000	<1	. .
Tasks (T)	1	0.0500	<1	. .
Rations (R)	1	0.2000	<1	. .
t_1t_2	1	0.2000	<1	. .
t_1T	1	0.4500	<1	. .
t_1R	1	28.8000	22.05	.001
t_2T	1	3.2000	2.4	. .
t_2R	1	0.0500	<1	. .
TR	1	0.2000	<1	. .
t_1t_2T	1	9.8000	7.50	.01
t_1t_2R	1	0.0500	<1	. .
t_1TR	1	0.8000	<1	. .
t_2TR	1	2.4500	1.88	. .
t_1t_2TR	1	4.0500	3.10	.10
Residual	64	1.3062	. .	. .

TABLE 88--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.55	5.25	5.40
II	5.40	5.30	5.35
Avg.	5.48	5.28	5.38

B. Cycle × Task

Cycle	sled	back
I	5.15	5.50
II	5.40	5.30
Avg.	5.28	5.40

C. Cycle × Ration

Cycle	High	Low
I	5.95	4.85
II	4.70	6.00
Avg.	5.32	5.43

D. Phase × Task

Phase	sled	back
1	5.65	5.30
2	5.05	5.50

E. Phase × Ration

Phase	High	Low
1	5.45	5.50
2	5.20	5.35

F. Ration × Task

Ration	sled	back
High	5.35	5.30
Low	5.35	5.50

G. Cycle × Phase × Ration

Cycle	Phase	Ration High	Ration Low
I	Phase 1	6.10	5.00
	Phase 2	5.80	4.70
II	Phase 1	4.80	6.00
	Phase 2	4.60	6.00

H. Cycle × Phase × Task

Cycle	Phase	Task sled	Task back
I	Phase 1	5.60	5.80
	Phase 2	5.30	5.20
II	Phase 1	6.00	4.80
	Phase 2	4.80	5.80

I. Cycle × Task × Ration

Cycle	Task	Ration High	Ration Low
I	sled	5.70	4.60
	back	5.90	5.10
II	sled	4.70	6.10
	back	4.70	5.90

J. Phase × Ration × Task

Phase	Ration	Task sled	Task back
1	High	5.55	5.40
	Low	5.80	5.20
2	High	5.20	5.20
	Low	4.90	5.80

K. Cycle × Phase × Ration / Task

Cycle	Phase	High sled	High back	Low sled	Low back
I	Phase 1	5.60	6.60	5.00	5.00
	Phase 2	6.40	5.20	4.20	5.20
II	Phase 1	5.40	4.20	6.60	5.40
	Phase 2	4.00	5.20	5.60	6.40

TABLE 89

LEVEL THAT "CHECKING UP ON EACH OTHER" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-7)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.5125	2.20	. .
Phases (t_2)	1	0.0125	< 1	. .
Tasks (T)	1	0.1125	< 1	. .
Rations (R)	1	3.6125	1.44	. .
t_1t_2	1	0.1125	< 1	. .
t_1T	1	0.0125	< 1	. .
t_1R	1	15.3125	6.11	.05
t_2T	1	6.6125	2.64	. .
t_2R	1	1.5125	< 1	. .
TR	1	2.8125	1.12	. .
t_1t_2T	1	13.6125	5.43	.05
t_1t_2R	1	1.5125	< 1	. .
t_1TR	1	1.0125	< 1	. .
t_2TR	1	5.5125	2.20	. .
t_1t_2TR	1	0.0125	< 1	. .
Residual	64	2.5062	. .	. .

TABLE 89--Continued

Mean Values

A. Phase

		1	2	Avg.
Cycle	I	4.15	4.20	4.18
	II	4.75	4.65	4.70
	Avg.	4.45	4.42	4.44

B. Task

		sled	back
Cycle	I	4.20	4.15
	II	4.75	4.65
	Avg.	4.48	4.40

C. Ration

		High	Low
Cycle	I	4.40	3.95
	II	4.05	5.35
	Avg.	4.22	4.65

D. Task

		sled	back
Phase	1	4.20	4.70
	2	4.75	4.10

E. Ration

		High	Low
Phase	1	4.10	4.80
	2	4.35	4.50

F. Task

		sled	back
Ration	High	4.45	4.00
	Low	4.50	4.80

G. Ration

			High	Low
Cycle	I	Phase 1	4.10	4.20
		Phase 2	4.70	3.70
	II	Phase 1	4.10	5.40
		Phase 2	4.00	5.30

H. Task

			sled	back
Cycle	I	Phase 1	4.30	4.00
		Phase 2	4.10	4.30
	II	Phase 1	4.10	5.40
		Phase 2	5.40	3.90

I. Ration

		Task	High	Low
Cycle	I	sled	4.50	3.90
		back	4.30	4.00
	II	sled	4.40	5.10
		back	3.70	5.60

J. Task

		Ration	sled	back
Phase	1	High	4.30	3.90
		Low	4.10	5.50
	2	High	4.60	4.10
		Low	4.90	4.10

K. Ration / Task

			High		Low	
			sled	back	sled	back
Cycle	I	Phase 1	4.60	3.60	4.00	4.40
		Phase 2	4.40	5.00	3.80	3.60
	II	Phase 1	4.00	4.20	4.20	6.60
		Phase 2	4.80	3.20	6.00	4.60

TABLE 90

LEVEL THAT "GETTING BREAKS FOR EACH OTHER" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-4)

Analysis of Variance				
Source of Variation	**d. f.**	**Mean Square**	**F**	**Significance Level**
Cycles (t_1)	1	0.0500	< 1	. .
Phases (t_2)	1	0.2000	< 1	. .
Tasks (T)	1	0.4500	< 1	. .
Rations (R)	1	0.0000	< 1	. .
t_1t_2	1	0.0500	< 1	. .
t_1T	1	0.2000	< 1	. .
t_1R	1	4.0500	2.01	. .
t_2T	1	4.0500	2.01	. .
t_2R	1	1.8000	< 1	. .
TR	1	2.4500	1.22	. .
t_1t_2T	1	5.0000	2.48	. .
t_1t_2R	1	2.4500	1.22	. .
t_1TR	1	1.8000	< 1	. .
t_2TR	1	0.4500	< 1	. .
t_1t_2TR	1	0.2000	< 1	. .
Residual	64	2.0125	. .	. .

TABLE 90--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	4.50	4.45	4.48
II	4.60	4.45	4.52
Avg.	4.55	4.45	4.50

B. Task

Cycle	sled	back
I	4.35	4.60
II	4.50	4.55
Avg.	4.42	4.58

C. Ration

Cycle	High	Low
I	4.70	4.25
II	4.30	4.75
Avg.	4.50	4.50

D. Task

Phase	sled	back
1	4.25	4.85
2	4.60	4.30

E. Ration

Phase	High	Low
1	4.40	4.70
2	4.60	4.30

F. Task

Ration	sled	back
High	4.60	4.40
Low	4.25	4.75

G. Ration

Cycle		High	Low
I	Phase 1	4.40	4.60
	Phase 2	5.00	3.90
II	Phase 1	4.40	4.80
	Phase 2	4.20	4.70

H. Task

Cycle		sled	back
I	Phase 1	4.40	4.60
	Phase 2	4.30	4.60
II	Phase 1	4.10	5.10
	Phase 2	4.90	4.00

I. Ration

Cycle	Task	High	Low
I	sled	4.60	4.10
	back	4.80	4.40
II	sled	4.60	4.40
	back	4.00	5.10

J. Task

Phase	Ration	sled	back
1	High	4.20	4.60
	Low	4.30	5.10
2	High	5.00	4.20
	Low	4.20	4.40

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.20	4.60	4.60	4.60
	Phase 2	5.00	5.00	3.60	4.20
II	Phase 1	4.20	4.60	4.00	5.60
	Phase 2	5.00	3.40	4.80	4.60

TABLE 91

LEVEL THAT "LOOKING OUT FOR EACH OTHER" HOLDS IN TEAM
(QUESTIONNAIRE C, ITEM 3-6)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.5125	2.85	.10
Phases (t_2)	1	0.0125	< 1	. .
Tasks (T)	1	1.0125	< 1	. .
Rations (R)	1	0.0125	< 1	. .
t_1t_2	1	0.0125	< 1	. .
t_1T	1	2.1125	1.09	. .
t_1R	1	10.5125	5.44	.05
t_2T	1	9.1125	4.72	.05
t_2R	1	0.6125	< 1	. .
TR	1	6.6125	3.42	.10
t_1t_2T	1	0.0125	< 1	. .
t_1t_2R	1	1.5125	< 1	. .
t_1TR	1	0.0125	< 1	. .
t_2TR	1	0.6125	< 1	. .
t_1t_2TR	1	3.6125	1.87	. .
Residual	64	1.9312	. .	. .

TABLE 91--Continued

Mean Values

A.

		Phase 1	Phase 2	Avg.
Cycle	I	4.75	4.80	4.78
	II	5.30	5.30	5.30
	Avg.	5.02	5.05	5.04

B.

		Task sled	Task back
Cycle	I	5.05	4.50
	II	5.25	5.35
	Avg.	5.15	4.92

C.

		Ration High	Ration Low
Cycle	I	5.15	4.40
	II	4.95	5.65
	Avg.	5.05	5.02

D.

		Task sled	Task back
Phase	1	4.80	5.25
	2	5.50	4.60

E.

		Ration High	Ration Low
Phase	1	4.95	5.10
	2	5.15	4.95

F.

		Task sled	Task back
Ration	High	5.45	4.65
	Low	4.85	5.20

G.

			Ration High	Ration Low
Cycle	I	Phase 1	4.90	4.60
		Phase 2	5.40	4.20
	II	Phase 1	5.00	5.60
		Phase 2	4.90	5.70

H.

			Task sled	Task back
Cycle	I	Phase 1	4.70	4.80
		Phase 2	5.40	4.20
	II	Phase 1	4.90	5.70
		Phase 2	5.60	5.00

I.

		Task	Ration High	Ration Low
Cycle	I	sled	5.70	4.40
		back	4.60	4.40
	II	sled	5.20	5.30
		back	4.70	6.00

J.

		Ration	Task sled	Task back
Phase	1	High	5.10	4.80
		Low	4.50	5.70
	2	High	5.80	4.50
		Low	5.20	4.70

K.

			Ration / Task High sled	High back	Low sled	Low back
Cycle	I	Phase 1	5.00	4.80	4.40	4.80
		Phase 2	6.40	4.40	4.40	4.00
	II	Phase 1	5.20	4.80	4.60	6.60
		Phase 2	5.20	4.60	6.00	5.40

TABLE 92

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME IN THE TEAM THINK ONLY OF THEMSELVES, EVEN ON MATTERS THAT AFFECT EVERYBODY" (QUESTIONNAIRE B, ITEM 7-9)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.2000	<1	. .
Phases (t_2)	1	0.8000	<1	. .
Tasks (T)	1	1.2500	<1	. .
Rations (R)	1	4.0500	1.72	. .
t_1t_2	1	11.2500	4.79	.05
t_1T	1	0.8000	<1	. .
t_1R	1	7.2000	3.06	.10
t_2T	1	0.8000	<1	. .
t_2R	1	1.8000	<1	. .
TR	1	1.2500	<1	. .
t_1t_2T	1	4.0500	1.72	. .
t_1t_2R	1	2.4500	1.04	. .
t_1TR	1	0.0000	<1	. .
t_2TR	1	7.2000	3.06	.10
t_1t_2TR	1	0.0500	<1	. .
Residual	64	2.3500	. .	. .

TABLE 92--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	2.30	3.25	2.78
II	3.15	2.60	2.88
Avg.	2.72	2.92	2.83

B. Task

Cycle	sled	back
I	3.00	2.55
II	2.90	2.85
Avg.	2.95	2.70

C. Ration

Cycle	High	Low
I	2.25	3.30
II	2.95	2.80
Avg.	2.60	3.05

D. Task

Phase	sled	back
1	2.75	2.70
2	3.15	2.70

E. Ration

Phase	High	Low
1	2.65	2.80
2	2.55	3.30

F. Task

Ration	sled	back
High	2.85	2.35
Low	3.05	3.05

G. Ration

Cycle		High	Low
I	Phase 1	2.10	2.50
	Phase 2	2.40	4.10
II	Phase 1	3.20	3.10
	Phase 2	2.70	2.50

H. Task

Cycle		sled	back
I	Phase 1	2.20	2.40
	Phase 2	3.80	2.70
II	Phase 1	3.30	3.00
	Phase 2	2.50	2.70

I. Ration

Cycle	Task	High	Low
I	sled	2.60	3.40
	back	1.90	3.20
II	sled	3.10	2.70
	back	2.80	2.90

J. Task

Phase	Ration	sled	back
1	High	3.10	2.20
	Low	2.40	3.20
2	High	2.60	2.50
	Low	3.70	2.90

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	2.40	1.80	2.00	3.00
	Phase 2	2.80	2.00	4.80	3.40
II	Phase 1	3.80	2.60	2.80	3.40
	Phase 2	2.40	3.00	2.60	2.40

TABLE 93

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME IN THE TEAM DO MOST OF THE WORK AND OTHERS JUST SHARE IN THE CREDIT" (QUESTIONNAIRE B, ITEM 7-12)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.6125	<1	. .
Phases (t_2)	1	2.8125	1.31	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	1.0125	<1	. .
t_1t_2	1	4.5125	2.10	. .
t_1T	1	2.1125	<1	. .
t_1R	1	0.3125	<1	. .
t_2T	1	1.5125	<1	. .
t_2R	1	0.0125	<1	. .
TR	1	0.6125	<1	. .
t_1t_2T	1	12.0125	5.59	.05
t_1t_2R	1	2.8125	1.31	. .
t_1TR	1	5.5125	2.56	. .
t_2TR	1	27.6125	12.84	.001
t_1t_2TR	1	3.6125	1.68	. .
Residual	64	2.1500	. .	. .

TABLE 93--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	2.10	2.95	2.52
II	2.75	2.65	2.70
Avg.	2.42	2.80	2.61

B. Cycle × Task

Cycle	Task: sled	Task: back
I	2.75	2.30
II	2.60	2.80
Avg.	2.68	2.55

C. Cycle × Ration

Cycle	Ration: High	Ration: Low
I	2.35	2.70
II	2.65	2.75
Avg.	2.50	2.73

D. Phase × Task

Phase	Task: sled	Task: back
1	2.35	2.50
2	3.00	2.60

E. Phase × Ration

Phase	Ration: High	Ration: Low
1	2.30	2.55
2	2.70	2.90

F. Ration × Task

Ration	Task: sled	Task: back
High	2.65	2.35
Low	2.70	2.75

G. Cycle × Phase × Ration

Cycle		Ration: High	Ration: Low
I	Phase 1	2.10	2.10
	Phase 2	2.60	3.30
II	Phase 1	2.50	3.00
	Phase 2	2.80	2.50

H. Cycle × Phase × Task

Cycle		Task: sled	Task: back
I	Phase 1	1.80	2.40
	Phase 2	3.70	2.20
II	Phase 1	2.90	2.60
	Phase 2	2.30	3.00

I. Cycle × Task × Ration

Cycle	Task	Ration: High	Ration: Low
I	sled	2.40	3.10
	back	2.30	2.30
II	sled	2.90	2.30
	back	2.40	3.20

J. Phase × Ration × Task

Phase	Ration	Task: sled	Task: back
1	High	2.90	1.70
	Low	1.80	3.30
2	High	2.40	3.00
	Low	3.60	2.20

K. Cycle × Phase × Ration / Task

Cycle		High: sled	High: back	Low: sled	Low: back
I	Phase 1	2.00	2.20	1.60	2.60
	Phase 2	2.80	2.40	4.60	2.00
II	Phase 1	3.80	1.20	2.00	4.00
	Phase 2	2.00	3.60	2.60	2.40

TABLE 94

LEVEL OF ANNOYANCE AND IRRITATION WITH WORK-SHARING IN THE PAST DAY OR TWO (QUESTIONNAIRE C, ITEM 1A-2)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	2.8125	<1	. .
Phases (t_2)	1	5.5125	1.71	. .
Tasks (T)	1	0.3125	<1	. .
Rations (R)	1	6.6125	2.05	. .
t_1t_2	1	1.5125	<1	. .
t_1T	1	3.6125	1.12	. .
t_1R	1	0.6125	<1	. .
t_2T	1	1.0125	<1	. .
t_2R	1	0.0125	<1	. .
TR	1	0.0125	<1	. .
t_1t_2T	1	2.1125	<1	. .
t_1t_2R	1	0.6125	<1	. .
t_1TR	1	0.1125	<1	. .
t_2TR	1	12.0125	3.73	.10
t_1t_2TR	1	0.3125	<1	. .
Residual	64	3.2188	. .	. .

TABLE 94--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	3.75	4.00	3.88
II	3.10	3.90	3.50
Avg.	3.42	3.95	3.69

B.

Cycle	Task sled	Task back
I	4.15	3.60
II	3.35	3.65
Avg.	3.75	3.62

C.

Cycle	Ration High	Ration Low
I	3.50	4.25
II	3.30	3.70
Avg.	3.40	3.98

D.

Phase	Task sled	Task back
1	3.60	3.25
2	3.90	4.00

E.

Phase	Ration High	Ration Low
1	3.15	3.70
2	3.65	4.25

F.

Ration	Task sled	Task back
High	3.45	3.35
Low	4.05	3.90

G.

Cycle		Ration High	Ration Low
I	Phase 1	3.30	4.20
	Phase 2	3.70	4.30
II	Phase 1	3.00	3.20
	Phase 2	3.60	4.20

H.

Cycle		Task sled	Task back
I	Phase 1	4.30	3.20
	Phase 2	4.00	4.00
II	Phase 1	2.90	3.30
	Phase 2	3.80	4.00

I.

Cycle	Task	Ration High	Ration Low
I	sled	3.80	4.50
	back	3.20	4.00
II	sled	3.10	3.60
	back	3.50	3.80

J.

Phase	Ration	Task sled	Task back
1	High	3.70	2.60
	Low	3.50	3.90
2	High	3.20	4.10
	Low	4.60	3.90

K.

Cycle		Ration / Task High sled	High back	Low sled	Low back
I	Phase 1	4.20	2.40	4.40	4.00
	Phase 2	3.40	4.00	4.60	4.00
II	Phase 1	3.20	2.80	2.60	3.80
	Phase 2	3.00	4.20	4.60	3.80

TABLE 95

LEVEL OF ACCURACY OF THE STATEMENT THAT "SOME OF THE MEN ARE SHIRKING THEIR DUTY"
(QUESTIONNAIRE B, ITEM 7-18)

Analysis of Variance				
Source of Variation	**d. f.**	**Mean Square**	**F**	**Significance Level**
Cycles (t_1)	1	0.1125	<1	. .
Phases (t_2)	1	4.5125	2.29	. .
Tasks (T)	1	0.1125	<1	. .
Rations (R)	1	0.0125	<1	. .
t_1t_2	1	4.5125	2.29	. .
t_1T	1	0.6125	<1	. .
t_1R	1	5.5125	2.80	. .
t_2T	1	1.0125	<1	. .
t_2R	1	0.3125	<1	. .
TR	1	0.3125	<1	. .
t_1t_2T	1	19.0125	9.66	.01
t_1t_2R	1	0.3125	<1	. .
t_1TR	1	0.0125	<1	. .
t_2TR	1	21.0125	10.67	.01
t_1t_2TR	1	0.0125	<1	. .
Residual	64	1.9688	. .	. .

TABLE 95--Continued

Mean Values

A.

		Phase 1	Phase 2	Phase Avg.
Cycle	I	2.15	3.10	2.62
	II	2.55	2.55	2.55
	Avg.	2.35	2.82	2.59

B.

		Task sled	Task back
Cycle	I	2.75	2.50
	II	2.50	2.60
	Avg.	2.62	2.55

C.

		Ration High	Ration Low
Cycle	I	2.35	2.90
	II	2.80	2.30
	Avg.	2.58	2.60

D.

		Task sled	Task back
Phase	1	2.50	2.20
	2	2.75	2.90

E.

		Ration High	Ration Low
Phase	1	2.40	2.30
	2	2.75	2.90

F.

		Task sled	Task back
Ration	High	2.55	2.60
	Low	2.70	2.50

G.

			Ration High	Ration Low
Cycle	I	Phase 1	2.00	2.30
		Phase 2	2.70	3.50
	II	Phase 1	2.80	2.30
		Phase 2	2.80	2.30

H.

			Task sled	Task back
Cycle	I	Phase 1	2.90	2.40
		Phase 2	3.60	2.60
	II	Phase 1	3.10	2.00
		Phase 2	2.90	3.20

I.

		Task	Ration High	Ration Low
Cycle	I	sled	2.40	3.10
		back	2.30	2.70
	II	sled	2.70	2.30
		back	2.90	2.30

J.

		Ration	Task sled	Task back
Phase	1	High	3.00	2.80
		Low	2.00	2.60
	2	High	2.10	3.40
		Low	3.40	2.40

K.

			Ration / Task High sled	High back	Low sled	Low back
Cycle	I	Phase 1	2.20	1.80	1.60	3.00
		Phase 2	2.60	2.80	4.60	2.40
	II	Phase 1	3.80	1.80	2.40	2.20
		Phase 2	1.60	4.00	2.20	2.40

TABLE 96

LEVEL OF ANNOYANCE AND IRRITATION WITH
SELFISHNESS IN THE PAST DAY OR TWO
(QUESTIONNAIRE C, ITEM 1A-15)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.6125	< 1	. .
Phases (t_2)	1	0.1125	< 1	. .
Tasks (T)	1	1.0125	< 1	. .
Rations (R)	1	0.0125	< 1	. .
t_1t_2	1	0.6125	< 1	. .
t_1T	1	1.5125	< 1	. .
t_1R	1	0.6125	< 1	. .
t_2T	1	0.0125	< 1	. .
t_2R	1	0.6125	< 1	. .
TR	1	0.0125	< 1	. .
t_1t_2T	1	4.5125	2.14	. .
t_1t_2R	1	0.0125	< 1	. .
t_1TR	1	0.0125	< 1	. .
t_2TR	1	3.6125	1.71	. .
t_1t_2TR	1	0.0125	< 1	. .
Residual	64	2.1125	. .	. .

TABLE 96--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	2.60	2.50	2.55
II	2.60	2.85	2.72
Avg.	2.60	2.68	2.64

B. Cycle × Task

Cycle	Task sled	Task back
I	2.80	2.30
II	2.70	2.75
Avg.	2.75	2.52

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	2.65	2.45
II	2.65	2.80
Avg.	2.65	2.62

D. Phase × Task

Phase	Task sled	Task back
1	2.70	2.50
2	2.80	2.55

E. Phase × Ration

Phase	Ration High	Ration Low
1	2.70	2.50
2	2.60	2.75

F. Ration × Task

Ration	Task sled	Task back
High	2.75	2.55
Low	2.75	2.50

G.

Cycle		Ration High	Ration Low
I	Phase 1	2.80	2.40
	Phase 2	2.50	2.50
II	Phase 1	2.60	2.60
	Phase 2	2.70	3.00

H.

Cycle		Task sled	Task back
I	Phase 1	2.60	2.60
	Phase 2	3.00	2.00
II	Phase 1	2.80	2.40
	Phase 2	2.60	3.10

I.

Cycle	Task	Ration High	Ration Low
I	sled	2.90	2.70
	back	2.40	2.20
II	sled	2.60	2.80
	back	2.70	2.80

J.

Phase	Ration	Task sled	Task back
1	High	3.00	2.40
	Low	2.40	2.60
2	High	2.50	2.70
	Low	3.10	2.90

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	3.00	2.60	2.20	2.60
	Phase 2	2.80	2.20	3.20	1.80
II	Phase 1	3.00	2.20	2.60	2.60
	Phase 2	2.20	3.20	3.00	3.00

TABLE 97

LEVEL OF PREFERENCE TO HAVE TEAMMATES AS CO-MEMBERS IN ANOTHER TEAM AGAIN (QUESTIONNAIRE B, ITEM 16)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	4.0500	< 1	. .
Phases (t_2)	1	6.0500	< 1	. .
Tasks (T)	1	6.0500	< 1	. .
Rations (R)	1	8.4500	1.16	. .
t_1t_2	1	0.8000	< 1	. .
t_1T	1	9.8000	1.34	. .
t_1R	1	145.8000	19.97	.001
t_2T	1	57.8000	7.92	.01
t_2R	1	9.8000	1.34	. .
TR	1	3.2000	< 1	. .
t_1t_2T	1	1.2500	< 1	. .
t_1t_2R	1	1.2500	< 1	. .
t_1TR	1	0.4500	< 1	. .
t_2TR	1	4.0500	< 1	. .
t_1t_2TR	1	1.8000	< 1	. .
Residual	64	7.3000	. .	. .

TABLE 97--Continued

Mean Values

A. Cycle × Phase

Cycle	Phase 1	Phase 2	Avg.
I	5.66	5.48	5.57
II	5.50	5.41	5.46
Avg	5.58	5.44	5.51

B. Cycle × Task

Cycle	Task sled	Task back
I	5.39	5.75
II	5.48	5.44
Avg	5.43	5.59

C. Cycle × Ration

Cycle	Ration High	Ration Low
I	5.82	5.31
II	5.04	5.88
Avg	5.43	5.59

D. Phase × Task

Phase	Task sled	Task back
1	5.30	5.86
2	5.56	5.32

E. Phase × Ration

Phase	Ration High	Ration Low
1	5.41	5.75
2	5.45	5.44

F. Ration × Task

Ration	Task sled	Task back
High	5.34	5.52
Low	5.52	5.66

G.

Cycle		Ration High	Ration Low
I	Phase 1	5.80	5.52
	Phase 2	5.85	5.10
II	Phase 1	5.02	5.98
	Phase 2	5.05	5.78

H.

Cycle		Task sled	Task back
I	Phase 1	5.32	6.00
	Phase 2	5.45	5.50
II	Phase 1	5.28	5.72
	Phase 2	5.68	5.15

I.

Cycle	Task	Ration High	Ration Low
I	sled	5.55	5.22
	back	6.10	5.40
II	sled	5.12	5.82
	back	4.95	5.92

J.

Phase	Ration	Task sled	Task back
1	High	5.12	5.70
	Low	5.48	6.02
2	High	5.55	5.35
	Low	5.58	5.30

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	5.40	6.20	5.25	5.80
	Phase 2	5.70	6.00	5.20	5.00
II	Phase 1	4.85	5.20	5.70	6.25
	Phase 2	5.40	4.70	5.95	5.60

TABLE 98

AVERAGE RATINGS OF TEAMMATES' PERFORMANCES
(QUESTIONNAIRE B, ITEM 8)

Analysis of Variance				
Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	5.5125	< 1	. .
Phases (t_2)	1	6.6125	< 1	. .
Tasks (T)	1	0.1125	< 1	. .
Rations (R)	1	19.0125	1.42	. .
t_1t_2	1	2.8125	< 1	. .
t_1T	1	0.6125	< 1	. .
t_1R	1	255.6125	19.09	.001
t_2T	1	27.6125	2.06	. .
t_2R	1	1.0125	< 1	. .
TR	1	2.8125	< 1	. .
t_1t_2T	1	70.3125	5.25	.05
t_1t_2R	1	2.8125	< 1	. .
t_1TR	1	10.5125	< 1	. .
t_2TR	1	94.6125	7.07	.01
t_1t_2TR	1	17.1125	1.28	. .
Residual	64	13.3875	. .	. .

TABLE 98--Continued

Mean Values

A.

Cycle	Phase 1	Phase 2	Avg.
I	5.58	5.52	5.55
II	5.80	5.56	5.68
Avg.	5.69	5.54	5.62

B.

Cycle	Task: sled	Task: back
I	5.54	5.56
II	5.45	5.91
Avg.	5.49	5.74

C.

Cycle	Ration: High	Ration: Low
I	5.88	5.22
II	5.11	6.25
Avg.	5.49	5.74

D.

Phase	Task: sled	Task: back
1	5.55	5.82
2	5.44	5.65

E.

Phase	Ration: High	Ration: Low
1	5.54	5.84
2	5.45	5.64

F.

Ration	Task: sled	Task: back
High	5.29	5.70
Low	5.70	5.90

G.

Cycle		Ration: High	Ration: Low
I	Phase 1	5.82	5.32
	Phase 2	5.92	5.12
II	Phase 1	5.25	6.35
	Phase 2	4.98	6.15

H.

Cycle		Task: sled	Task: back
I	Phase 1	5.65	5.50
	Phase 2	5.42	5.62
II	Phase 1	5.45	6.15
	Phase 2	5.45	5.68

I.

Cycle	Task	Ration: High	Ration: Low
I	sled	6.00	5.08
	back	5.75	5.38
II	sled	4.58	6.32
	back	5.65	6.18

J.

Phase	Ration	Task: sled	Task: back
1	High	5.18	5.90
	Low	5.92	5.75
2	High	5.40	5.50
	Low	5.48	5.80

K.

Cycle		Ration / Task: High sled	High back	Low sled	Low back
I	Phase 1	5.65	6.00	5.65	5.00
	Phase 2	6.35	5.50	4.50	5.75
II	Phase 1	4.70	5.80	6.20	6.50
	Phase 2	4.45	5.50	6.45	5.85

TABLE 99

LEVEL OF ACCURACY OF THE STATEMENT THAT "I WOULD RATHER BE WITH MY PRESENT TEAM THAN WITH ANY OF THE OTHER TEAMS" (QUESTIONNAIRE B, ITEM 7-20)

Analysis of Variance

Source of Variation	d. f.	Mean Square	F	Significance Level
Cycles (t_1)	1	0.4500	<1	. .
Phases (t_2)	1	0.0000	<1	. .
Tasks (T)	1	3.2000	1.01	. .
Rations (R)	1	0.0500	<1	. .
t_1t_2	1	0.0500	<1	. .
t_1T	1	0.0500	<1	. .
t_1R	1	24.2000	7.65	.01
t_2T	1	7.2000	2.28	. .
t_2R	1	0.4500	<1	. .
TR	1	1.2500	<1	. .
t_1t_2T	1	1.2500	<1	. .
t_1t_2R	1	0.8000	<1	. .
t_1TR	1	0.2000	<1	. .
t_2TR	1	1.2500	<1	. .
t_1t_2TR	1	7.2000	2.28	. .
Residual	64	3.1625	. .	. .

TABLE 99--Continued

Mean Values

A. Phase

Cycle	1	2	Avg.
I	4.95	4.90	4.92
II	5.05	5.10	5.08
Avg	5.00	5.00	5.00

B. Task

Cycle	sled	back
I	4.70	5.15
II	4.90	5.25
Avg	4.80	5.20

C. Ration

Cycle	High	Low
I	5.45	4.40
II	4.50	5.65
Avg	4.98	5.02

D. Task

Phase	sled	back
1	4.50	5.50
2	5.10	4.90

E. Ration

Phase	High	Low
1	4.90	5.10
2	5.05	4.95

F. Task

Ration	sled	back
High	4.90	5.05
Low	4.70	5.35

G. Ration

Cycle		High	Low
I	Phase 1	5.50	4.40
	Phase 2	5.40	4.40
II	Phase 1	4.30	5.80
	Phase 2	4.70	5.50

H. Task

Cycle		sled	back
I	Phase 1	4.30	5.60
	Phase 2	5.10	4.70
II	Phase 1	4.70	5.40
	Phase 2	5.10	5.10

I. Ration

Cycle	Task	High	Low
I	sled	5.40	4.00
	back	5.50	4.80
II	sled	4.40	5.40
	back	4.60	5.90

J. Task

Phase	Ration	sled	back
1	High	4.40	5.60
	Low	4.60	4.70
2	High	5.40	5.40
	Low	4.80	5.10

K. Ration / Task

Cycle		High sled	High back	Low sled	Low back
I	Phase 1	4.60	6.40	4.00	4.80
	Phase 2	6.20	4.60	4.00	4.80
II	Phase 1	4.20	4.40	5.20	6.40
	Phase 2	4.60	4.80	5.60	5.40

TABLE 100

MEMBERS' RANKINGS OF THEIR TEAM CO-MEMBERS IN THE ORDER IN WHICH THEY FELT THOSE MEMBERS WOULD MAKE GOOD LEADERS ON ANOTHER TEAM IN THE FOLLOWING YEAR (QUESTIONNAIRE C, ITEM 5)

Rank Matrices: Full-fed Teams

		Phase 1					Phase 2				
Individuals:		1[a]	2	4	5	6	1[a]	2	4	5	6
	1	..	3	2	4	1	..	3	2	4	1
	2	1	..	3	4	2	4	..	3	2	1
Team A	4	3	2	..	4	1	1	2	..	4	3
	5	3	1	2	..	4	1	2	3	..	4
	6	1	4	2	3	..	1	4	2	3	..
Sums		8	10	9	15	8	7	11	10	13	9
Hohn's h		.38					.22				
Individuals:		12[a]	11	7	8	9	12[a]	11	7	8	9
	12	..	1	4	2	3	..	3	4	2	1
	11	2	..	4	1	3	3	..	1	2	4
Team B	7	3	1	..	2	4	3	1	..	2	4
	8	2	1	3	..	4	1	2	3	..	4
	9	3	2	1	4	..	4	3	1	2	..
Sums		10	5	12	9	14	11	9	9	8	13
Hohn's h		.51					.18				
Individuals:		13[a]	14	19	20	21	13[a]	14	19	20	21
	13	..	2	1	3	4	..	2	1	3	4
	14	1	..	2	4	3	1	..	3	4	2
Team C'	19	2	4	..	1	3	4	2	..	1	3
	20	2	3	1	..	4	1	4	2	..	3
	21	3	1	2	4	..	2	1	3	4	..
Sums		8	10	6	12	14	8	9	9	12	12
Hohn's h		.44					.16				
Individuals:		24[a]	23	16	17	18	24[a]	23	16	17	18
	24	..	1	4	3	2	..	1	4	3	2
	23	4	..	2	1	3	4	..	1	2	3
Team D'	16	1	3	..	2	4	3	2	..	1	4
	17	1	4	2	..	3	1	4	2	..	3
	18	2	4	3	1	..	3	4	2	1	..
Sums		8	12	11	7	12	11	11	9	7	12
Hohn's h		.24					.18				

[a]Leader

TABLE 100--Continued

Rank Matrices: Underfed Teams											
	Phase 1					Phase 2					
Individuals:	1[a]	2	7	8	9	1[a]	2	7	8	9
1	..	4	1	2	3	..	4	1	2	3
2	4	..	1	2	3	4	..	1	2	3
Team A' 7	4	2	..	1	3	3	2	..	1	4
8	3	2	1	..	4	1	3	2	..	4
9	2	1	4	3	..	1	2	4	3	..
Sums	13	9	7	8	13	9	11	8	8	14
Hohn's h	.36					.29				
Individuals:	12[a]	11	4	5	6	12[a]	11	4	5	6
12	..	4	2	3	1	..	4	3	1	2
11	4	..	2	3	1	4	..	2	3	1
Team B' 4	2	1	..	3	4	4	3	..	2	1
5	1	4	2	..	3	1	2	3	..	4
6	2	1	3	4	..	2	1	3	4	..
Sums	9	10	9	13	9	11	10	11	10	8
Hohn's h	.22					.07				
Individuals:	13[a]	14	16	17	18	13[a]	14	16	17	18
13	..	1	3	2	4	..	1	3	2	4
14	1	..	4	2	3	1	..	3	2	4
Team C 16	1	3	..	2	4	1	3	..	2	4
17	2	1	3	..	4	2	1	3	..	4
18	3	2	4	1	..	4	2	3	1	..
Sums	7	7	14	7	15	8	7	12	7	16
Hohn's h	.76					.69				
Individuals:	24[a]	23	19	20	21	24[a]	23	19	20	21
24	..	3	2	1	4	..	3	1	2	4
23	4	..	2	1	3	4	..	1	2	3
Team D 19	2	4	..	1	3	4	3	..	1	2
20	4	2	1	..	3	4	2	1	..	3
21	4	3	2	1	..	4	3	1	2	..
Sums	14	12	7	4	13	16	11	4	7	12
Hohn's h	.82					.87				

[a]Leader

TABLE 101

MEMBERS' RANKINGS OF THEIR TEAM CO-MEMBERS IN THE ORDER IN WHICH THEY WORKED MOST CLOSELY WITH THOSE MEMBERS DURING THE PREVIOUS FEW DAYS (QUESTIONNAIRE B, ITEM 5)

Rank Matrices: Full-fed Teams											
		Phase 1					Phase 2				
Individuals:		1[a]	2	4	5	6	1[a]	2	4	5	6
Team A	1	..	4	2	3	1	..	4	3	1	2
	2	4	..	1	3	2	4	..	2	3	1
	4	1	3	..	4	2	1	4	..	2	3
	5	1	4	2	..	3	2	1	3	..	4
	6	4	1	3	2	..	4	3	1	2	..
	Sums	10	12	8	12	8	11	12	9	8	10
	Hohn's h	.18					.12				
Individuals:		12[a]	11	7	8	9	12[a]	11	7	8	9
Team B	12	..	1	4	2	3	..	2	3	4	1
	11	2	..	4	1	3	2	..	4	1	3
	7	3	4	..	1	2	4	3	..	1	2
	8	3	1	2	..	4	4	1	2	..	3
	9	1	2	3	4	..	2	1	4	3	..
	Sums	9	8	13	8	12	12	7	13	9	9
	Hohn's h	.24					.26				
Individuals:		13[a]	14	19	20	21	13[a]	14	19	20	21
Team C'	13	..	2	1	3	4	..	1	2	3	4
	14	1	..	3	4	2	1	..	3	4	2
	19	2	3	..	1	4	2	3	..	1	4
	20	2	3	1	..	4	2	3	1	..	4
	21	2	1	3	4	..	1	2	3	4	..
	Sums	7	9	8	12	14	6	9	9	12	14
	Hohn's h	.37					.42				
Individuals:		24[a]	23	16	17	18	24[a]	23	16	17	18
Team D'	24	..	1	3	2	4	..	1	3	4	2
	23	1	..	2	4	3	1	..	4	3	2
	16	3	2	..	1	4	4	3	..	2	1
	17	2	4	3	..	1	3	4	2	..	1
	18	4	3	2	1	..	3	4	1	2	..
	Sums	10	10	10	8	12	11	12	10	11	6
	Hohn's h	.09					.24				

[a]Leader

TABLE 101--Continued

		Rank Matrices: Underfed Teams									
		Phase 1					Phase 2				
Individuals:		1[a]	2	7	8	9	1[a]	2	7	8	9
	1	..	2	4	3	1	..	4	3	1	2
	2	4	..	2	1	3	3	..	2	1	4
Team A'	7	4	2	..	1	3	4	3	..	1	2
	8	3	1	2	..	4	3	2	1	..	4
	9	1	4	2	3	..	1	4	2	3	11
Sums		12	9	10	8	11	11	13	8	6	12
Hohn's h		.12					.37				
Individuals:		12[a]	11	4	5	6	12[a]	11	4	5	6
	12	..	1	4	2	3	..	2	4	1	3
	11	4	..	2	3	1	4	..	2	3	1
Team B'	4	4	2	..	3	1	4	2	..	1	3
	5	2	4	1	..	3	1	4	2	..	3
	6	3	1	2	4	..	2	1	3	4	..
Sums		13	8	9	12	8	11	9	11	9	10
Hohn's h		.29					.04				
Individuals:		13[a]	14	16	17	18	13[a]	14	16	17	18
	13	..	1	3	2	4	..	3	1	2	4
	14	2	..	3	1	4	2	..	3	1	4
Team C	16	2	3	..	1	4	1	3	..	2	4
	17	3	1	2	..	4	3	1	2		4
	18	3	2	4	1	..	4	2	3	1	..
Sums		19	7	12	5	16	10	9	9	6	16
Hohn's h		.81					.59				
Individuals:		24[a]	23	19	20	21	24[a]	23	19	20	21
	24	..	2	3	1	4	..	1	2	3	4
	23	4	..	1	2	3	4	..	1	2	3
Team D	19	2	4	..	1	3	4	3	..	1	2
	20	4	3	1	..	2	4	3	1	..	2
	21	4	1	2	3	..	4	2	1	3	..
Sums		14	10	7	7	12	16	9	5	9	11
Hohn's h		.42					.70				

[a]Leader

TABLE 102

MEMBERS' RANKINGS OF THEIR TEAM CO-MEMBERS IN THE ORDER IN WHICH THOSE MEMBERS CONTRIBUTED GOOD ANSWERS TO TEAM PROBLEMS DURING THE PREVIOUS FEW DAYS (QUESTIONNAIRE B, ITEM 12)

Rank Matrices: Full-fed Teams		Phase 1					Phase 2				
Individuals:		1[a]	2	4	5	6	1[a]	2	4	5	6
Team A	1	..	3	2	4	1	..	4	2	3	1
	2	1	..	3	4	2	1	..	4	3	2
	4	1	3	..	2	4	1	2	..	4	3
	5	2	1	4	..	3	1	2	3	..	4
	6	1	3	2	4	..	1	4	2	3	..
Sums		5	10	11	14	10	4	12	11	13	10
Hohn's h		.47					.56				
Individuals:		12[a]	11	7	8	9	12[a]	11	7	8	9
Team B	12	..	1	4	3	2	..	2	1	4	3
	11	1	..	4	2	3	3	..	1	2	4
	7	3	2	..	1	4	3	2	..	1	4
	8	2	1	3	..	4	3	1	2	..	4
	9	1	4	2	3	..	1	2	4	3	..
Sums		7	8	13	9	13	10	7	8	10	15
Hohn's h		.26					.42				
Individuals:		13[a]	14	19	20	21	13[a]	14	19	20	21
Team C'	13	..	3	1	2	4	..	1	2	3	4
	14	1	..	4	3	2	1	..	2	4	3
	19	2	4	..	1	3	2	4	..	1	3
	20	2	4	1	..	3	1	2	3	..	4
	21	1	2	3	4	..	1	4	3	2	..
Sums		6	13	9	10	12	5	11	10	10	14
Hohn's h		.33					.47				
Individuals:		24[a]	23	16	17	18	24[a]	23	16	17	18
Team D'	24	..	3	2	1	4	..	1	3	4	2
	23	4	..	1	2	3	4	..	1	3	2
	16	1	4	..	2	3	3	4	..	1	2
	17	1	4	3	..	2	1	4	3	..	2
	18	2	4	3	1	..	3	4	2	1	..
Sums		8	15	9	6	12	11	13	9	9	8
Hohn's h		.56					.18				

[a]Leader

Table 102--Continued

Rank Matrices: Underfed Teams		Phase 1					Phase 2				
	Individuals:	1[a]	2	7	8	9	1[a]	2	7	8	9
	1	..	4	1	2	3	..	4	1	2	3
	2	3	..	1	2	4	3	..	1	2	4
Team A'	7	3	2	..	1	4	3	2	..	1	4
	8	1	2	3	..	4	1	3	2	..	4
	9	1	2	4	3	..	1	3	2	4	..
	Sums	8	10	9	8	15	8	12	6	9	15
	Hohn's h	.42					.56				
	Individuals:	12[a]	11	4	5	6	12[a]	11	4	5	6
	12	..	1	3	2	4	..	1	4	2	3
	11	4	..	1	3	2	4	..	1	3	2
Team B'	4	4	1	..	3	2	4	1	..	2	3
	5	1	2	3	..	4	1	2	3	..	4
	6	2	1	4	3	..	2	1	3	4	..
	Sums	11	5	11	11	12	11	5	11	11	12
	Hohn's h	.36					.36				
	Individuals:	13[a]	14	16	17	18	13[a]	14	16	17	18
	13	..	1	2	3	4	..	2	3	1	4
	14	2	..	4	1	3	3	..	4	1	2
Team C	16	1	3	..	2	4	2	3	..	1	4
	17	2	1	3	..	4	2	1	3	..	4
	18	3	2	4	1	..	4	2	3	1	..
	Sums	8	7	13	7	15	11	8	13	4	14
	Hohn's h	.62					.73				
	Individuals:	24[a]	23	19	20	21	24[a]	23	19	20	21
	24	..	2	1	3	4	..	2	3	1	4
	23	4	..	1	2	3	4	..	2	1	3
Team D	19	4	3	..	1	2	3	4	..	1	2
	20	3	4	1	..	2	3	4	2	..	1
	21	2	1	3	4	..	3	4	1	2	..
	Sums	13	10	6	10	11	13	14	8	4	11
	Hohn's h	.29					.73				

[a]Leader

TABLE 103

MEMBERS' NOMINATIONS OF TWO[a] TEAM CO-MEMBERS
WHO WERE MOST HELPFUL AND SYMPATHETIC
DURING THE PREVIOUS FEW DAYS
(QUESTIONNAIRE B, ITEM 14)

Rank Matrices: Full-fed Teams											
		Phase 1					Phase 2				
Individuals:		1[b]	2	4	5	6	1[b]	2	4	5	6
	1	..	3	1	3	2	..	3	1	2	3
	2	3	..	1	3	2	3	..	2	3	1
Team A	4	1	3	..	2	3	1	3	..	3	2
	5	2	3	1	..	3	2	3	1	..	3
	6	1	3	2	3	..	3	2	3	1	..
Sums		7	12	5	11	10	9	11	7	9	9
Individuals:		12[b]	11	7	8	9	12[b]	11	7	8	9
	12	..	3	3	1	2	..	2	3	3	1
	11	3	..	3	1	2	3	..	3	1	2
Team B	7	3	2	..	1	3	3	2	..	1	3
	8	3	2	1	..	3	3	2	1	..	3
	9	1	2	3	3	..	1	2	3	3	..
Sums		10	9	10	6	10	10	8	10	8	9
Individuals:		13[b]	14	19	20	21	13[b]	14	19	20	21
	13	..	2	1	3	3	..	2	1	3	3
	14	1	..	3	3	2	1	..	2	3	3
Team C'	19	2	3	..	1	3	3	3	..	2	1
	20	2	3	1	..	3	1	3	2	..	3
	21	1	3	2	3	..	1	3	2	3	..
Sums		6	11	7	10	11	6	11	7	11	10
Individuals:		24[b]	23	16	17	18	24[b]	23	16	17	18
	24	..	1	2	3	3	..	1	2	3	3
	23	3	..	1	2	3	3	..	2	1	3
Team D'	16	3	2	..	1	3	2	3	..	1	3
	17	2	3	3	..	1	3	3	2	..	1
	18	3	1	2	3	..	3	1	2	3	..
Sums		11	7	8	9	10	11	8	8	8	10

[a]The two persons named have been ranked in the order that they were listed. Three's have been inserted in cells of not-named individuals to permit comparison of column sums. Hohn's h was not computed.

[b]Leader

TABLE 103—Continued

		Rank Matrices: Underfed Teams									
		Phase 1					Phase 2				
Individuals:		1[a]	2	7	8	9	1[a]	2	7	8	9
	1	..	3	3	1	2	..	3	3	1	2
	2	3	..	2	1	3	3	..	1	2	3
Team A'	7	3	2	..	1	3	3	2	..	1	3
	8	3	2	1	..	3	3	1	2	..	3
	9	2	3	1	3	..	2	3	3	1	..
Sums		11	10	7	6	11	11	9	9	5	11
Individuals:		12[a]	11	4	5	6	12[a]	11	4	5	6
	12	..	3	1	2	3	..	3	3	1	2
	11	3	..	2	3	1	3	..	2	3	1
Team B'	4	3	1	..	3	2	3	1	..	3	2
	5	1	3	2	..	3	1	3	2	..	3
	6	3	1	2	3	..	3	1	3	2	..
Sums		10	8	7	11	9	10	8	10	9	8
Individuals:		13[a]	14	16	17	18	13[a]	14	16	17	18
	13	..	1	2	3	3	..	1	2	3	3
	14	2	..	3	1	3	2	..	3	1	3
Team C	16	1	3	..	2	3	2	3	..	1	3
	17	3	1	2	..	3	3	1	3	..	2
	18	3	3	1	2	..	3	2	1	3	..
Sums		9	8	8	8	12	10	7	9	8	11
Individuals:		24[a]	23	19	20	21	24[a]	23	19	20	21
	24	..	1	3	3	2	..	1	2	3	3
	23	3	..	1	2	3	3	..	2	1	3
Team D	19	1	2	..	3	3	3	3	..	1	2
	20	1	2	3	..	3	3	2	1	..	3
	21	3	2	1	3	..	3	2	1	3	..
Sums		8	7	8	11	11	12	8	6	8	11

[a]Leader

TABLE 104

MEMBERS' RANKINGS OF THEIR TEAM CO-MEMBERS IN THE ORDER IN WHICH THOSE MEMBERS' OPINIONS AND IDEAS HAD WEIGHT AND INFLUENCE IN THE GROUP AS A WHOLE (QUESTIONNAIRE B, ITEM 15)

Rank Matrices: Full-fed Teams											
		Phase 1					Phase 2				
Individuals:		1[a]	2	4	5	6	1[a]	2	4	5	6
	1	..	1	2	4	3	..	4	2	3	1
	2	1	..	3	4	2	1	..	4	2	3
Team A	4	1	3	..	4	2	1	2	..	4	3
	5	1	2	3	..	4	1	2	3	..	4
	6	1	2	4	3	..	1	4	3	2	..
Sums		4	8	12	15	11	4	12	12	11	11
Hohn's h		.78					.51				
Individuals:		12[a]	11	7	8	9	12[a]	11	7	8	9
	12	..	1	3	2	4	..	1	4	3	2
	11	1	..	3	2	4	1	..	2	3	4
Team B	7	4	1	..	2	3	3	1	..	2	4
	8	1	2	3	..	4	1	2	3	..	4
	9	2	1	3	4	..	1	2	3	4	..
Sums		8	5	12	10	15	6	6	12	12	14
Hohn's h		.60					.62				
Individuals:		13[a]	14	19	20	21	13[a]	14	19	20	21
	13	..	3	1	2	4	..	3	1	2	4
	14	1	..	4	3	2	1	..	4	2	3
Team C'	19	1	4	..	2	3	1	4	..	2	3
	20	2	3	1	..	4	1	2	3	..	4
	21	1	2	4	3	..	1	4	3	2	..
Sums		5	12	10	10	13	4	13	11	8	14
Hohn's h		.42					.73				
Individuals:		24[a]	23	16	17	18	24[a]	23	16	17	18
	24	..	2	3	1	4	..	3	2	4	1
	23	4	..	1	2	3	4	..	1	3	2
Team D'	16	1	4	..	2	3	1	4	..	2	3
	17	1	4	2	..	3	3	4	2	..	1
	18	3	4	2	1	..	3	4	2	1	..
Sums		9	14	8	6	13	11	15	7	10	7
Hohn's h		.51					.61				

[a]Leader

TABLE 104--Continued

	Phase 1					Phase 2				
Rank Matrices: Underfed Teams										
Individuals:	1[a]	2	7	8	9	1[a]	2	7	8	9
1	..	4	1	2	3	..	3	1	2	4
2	1	..	2	3	4	1	..	2	3	4
Team A' 7	3	2	..	1	4	3	2	..	1	4
8	1	2	3	..	4	1	3	2	..	4
9	2	3	1	4	..	2	4	1	3	..
Sums	7	12	6	11	15	7	12	6	9	16
Hohn's h	.67					.73				
Individuals:	12[a]	11	4	5	6	12[a]	11	4	5	6
12	..	1	3	2	4	..	1	4	3	2
11	4	..	2	3	1	1	..	3	4	2
Team B' 4	2	1	..	4	3	1	4	..	3	2
5	3	1	2	..	4	2	1	3	..	4
6	1	2	4	3	..	2	1	3	4	..
Sums	10	5	11	12	12	6	7	13	14	10
Hohn's h	.38					.56				
Individuals:	13[a]	14	16	17	18	13[a]	14	16	17	18
13	..	2	3	1	4	..	1	3	2	4
14	1	..	4	2	3	1	..	4	2	3
Team C 16	2	3	..	1	4	2	3	..	1	4
17	1	3	2	..	4	2	1	3	..	4
18	2	3	4	1	..	4	2	3	1	..
Sums	6	11	13	5	15	9	7	13	6	15
Hohn's h	.84					.67				
Individuals:	24[a]	23	19	20	21	24[a]	23	19	20	21
24	..	3	2	1	4	..	3	2	1	4
23	4	..	1	2	3	4	..	2	1	3
Team D 19	1	4	..	2	3	3	4	..	1	2
20	3	2	1	..	4	3	4	2	..	1
21	2	4	3	1	..	1	4	3	2	..
Sums	19	13	7	6	14	11	15	9	5	10
Hohn's h	.56					.51				

[a]Leader

TABLE 105

MEMBERS' RATINGS OF THEIR TEAM CO-MEMBERS IN TERMS OF THEIR PREFERENCE FOR THOSE MEMBERS AS POSSIBLE CO-MEMBERS ON ANOTHER FUTURE TEAM (QUESTIONNAIRE B, ITEM 16)

Rank Matrices: Full-fed Teams		Phase 1						Phase 2					
Individuals:		1[a]	2	4	5	6	Sums	1[a]	2	4	5	6	Sums
	1	..	4	6	4	6	20	..	5	6	6	6	23
	2	7	..	7	7	7	28	7	..	7	7	7	28
Team A	4	7	7	..	7	7	28	7	7	..	7	7	28
	5	2	3	1	..	4	10	5	4	6	..	4	19
	6	4	6	6	6	..	22	3	1	6	6	..	16
	Sums	20	20	20	24	24	108	22	17	25	26	24	114
Individuals:		12[a]	11	7	8	9	Sums	12[a]	11	7	8	9	Sums
	12	..	6	6	5	6	23	..	5	6	6	6	23
	11	7	..	7	7	7	28	7	..	7	7	7	28
Team B	7	5	7	..	7	6	25	4	7	..	7	5	23
	8	7	7	7	..	7	28	6	7	7	..	6	26
	9	5	5	5	5	..	20	5	5	5	5	..	20
	Sums	24	25	25	24	26	124	22	24	25	25	24	120
Individuals:		13[a]	14	19	20	21	Sums	13[a]	14	19	20	21	Sums
	13	..	6	6	6	5	23	..	6	6	6	5	23
	14	6	..	5	4	6	21	6	..	6	4	6	22
Team C'	19	5	3	..	6	3	17	5	2	..	7	3	17
	20	6	4	6	..	2	18	4	2	6	..	2	14
	21	4	5	5	4	..	18	5	4	5	4	..	18
	Sums	21	18	22	20	16	97	20	14	23	21	16	94
Individuals:		24[a]	23	16	17	18	Sums	24[a]	23	16	17	18	Sums
	24	..	6	6	6	6	24	..	6	6	5	6	23
	23	5	..	7	7	6	25	6	..	6	6	6	24
Team D'	16	2	5	..	5	5	17	4	4	..	7	7	22
	17	6	5	5	..	5	21	5	5	6	..	6	22
	18	2	5	5	5	..	17	3	5	5	4	..	17
	Sums	15	21	23	23	22	104	18	20	23	22	25	108

[a]Leader

TABLE 105--Continued

Rank Matrices: Underfed Teams		Phase 1						Phase 2					
Individuals:		1[a]	2	7	8	9	Sums	1[a]	2	7	8	9	Sums
	11	..	4	5	6	6	21	..	4	4	6	6	20
	22	7	..	7	7	7	28	7	..	7	7	7	28
Team A'	77	1	7	..	7	4	19	1	6	..	7	4	18
	88	6	7	7	..	6	26	6	7	7	..	6	26
	99	5	5	5	5	..	20	5	5	5	5	..	20
	Sums	19	23	24	25	23	114	19	22	23	25	23	112
Individuals:		12[a]	11	4	5	6	Sums	12[a]	11	4	5	6	Sums
	12	..	6	6	6	6	24	..	6	6	6	6	24
	11	4	..	7	7	7	25	5	..	7	5	7	24
Team B'	4	7	7	..	6	7	27	7	7	..	7	7	28
	5	6	6	6	..	6	24	6	6	6	..	4	22
	6	6	7	7	5	..	25	5	7	6	3	..	21
	Sums	23	26	26	24	26	125	23	26	25	21	24	119
Individuals:		13[a]	14	16	17	18	Sums	13[a]	14	16	17	18	Sums
	13	..	6	3	6	3	18	..	7	5	4	4	20
	14	6	..	4	6	4	20	7	..	5	5	5	22
Team C	16	7	7	..	7	7	28	7	7	..	7	6	27
	17	4	7	7	..	4	22	4	7	5	..	3	19
	18	5	5	2	5	..	17	4	4	4	4	..	16
	Sums	22	25	16	24	18	105	22	25	19	20	18	104
Individuals:		24[a]	23	19	20	21	Sums	24[a]	23	19	20	21	Sums
	24	..	7	7	7	5	26	..	7	7	7	4	25
	23	6	..	6	6	6	24	6	..	6	6	6	24
Team D	19	3	7	..	7	4	21	1	6	..	6	4	17
	20	6	7	7	..	7	27	4	5	7	..	5	21
	21	4	4	5	5	..	18	3	4	4	4	..	15
	Sums	19	25	25	25	22	116	14	22	24	23	19	102

[a]Leader

APPENDIX D

QUESTIONNAIRES

This appendix includes examples of the five different questionnaires used to procure response data appearing in this report. An illustrative schedule of the relative frequency of application of the questionnaires is shown in Table 21.

The Hour Questionnaire

____
(Your Name)

1. The LEVELS scale appears below. In the box at the right, write a number from the LEVELS scale to show the level of talkativeness in your team in the past hour. ☐

2. How hungry do you personally feel now, as compared with one hour ago? (check one box.)
   - ☐ Distinctly less hungry
   - ☐ Slightly less hungry
   - ☐ Slightly more hungry
   - ☐ Distinctly more hungry

3. In the box at the right write a number from the LEVELS scale to show your personal feeling of the level of rapidity (speed) that the past hour seemed to go by. ☐

4. Were you thinking about any special task problem in the past hour?
   - ☐ Yes
   - ☐ No

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very Low level	Somewhat low level	Medium level	Somewhat high level	Very High level	Extreme level

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5. (Answer only if you were thinking of some special task problem) The LEVELS scale is shown below. In the box at right, write a number from the LEVELS scale to show your own personal level of enjoyment of thinking about the special task problem. ☐

6. In each of the boxes below, write a number from the LEVELS scale to show the level or extent that you personally have felt affected in the past hour by each of the things tested below.

☐ CHAPPING BY SUN & WIND	☐ IRRITATION WITH TEAMMATES
☐ COLD	☐ GOOD LAUGHS
☐ GOOD FEELINGS TOWARD TEAMMATES	☐ THIRST
☐ HUNGER	☐ RESPECT FOR TEAMMATES
☐ OVEREATING	☐ ARGUMENTS
☐ TIREDNESS	☐ SORE FEET
☐ SOMETHING ELSE	

____
(Specify)

____

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very Low level	Somewhat low level	Medium level	Somewhat high level	Very High level	Extreme level

Fig. 18.--Questionnaire A, pages 1 and 2. This questionnaire focused on phenomena emerging during the one hour preceding lunch.

General Information Questionnaire (B)

NAME________________ TEAM________________

DATE________________

Answers to these questions are to be based on your past few days' experiences and observations. The purpose of the questionnaire is to get your views and opinions about how operations are going. Consider each question carefully and answer to the best of your ability. Remember, it is your personal opinions that are needed. Remember, also, that no one will see your answers except scientific personnel who analyze test results.

PERFORMANCE

1. In the box at right, write the number from the LEVELS scale which shows your best estimate of your own team's level of performance in operations and activities during the past four or five days. ☐

ARGUMENTS

2. Concerning which aspects of the past four or five days' duties and activities has there tended to be most argument and disagreement in your team?

SATISFACTION

3. Using the LEVELS scale, write a number in the box at right which best shows your own present level of satisfaction at being with your present team. ☐

GRIPE
(be specific)

4. What has been your own personal main gripe in the past few days?

5. In the spaces at the right, list the five members of your group in the order in which you have worked with them most closely during the past few days.

MOST CLOSELY
1.__________
2.__________
3.__________
4.__________
5.__________
LEAST CLOSELY

HAPPENINGS

6. At the right are a number of common complaints. In the box after each, write a number from the LEVELS scale which shows how much you have been affected by these complaints in the past few days.

Sex ☐
Weariness ☐
Overheating ☐
Hunger ☐
Thirst ☐
Cold ☐
Other ☐ (specify)

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very Low level	Somewhat Low level	Medium level	Somewhat High level	Very High level	Extreme level

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10 Jun' 60

Fig. 19.--Questionnaire B, page 1. This questionnaire focused on social and group phenomena emerging during the day or two previous to its administration.

7. In the boxes below are statements which may or may not accurately apply to your group, and at the bottom of the page is the LEVELS scale. Based on your past week's experiences, show your estimate of the level of accuracy of each statement for your group, by writing a LEVELS scale number in the space after each.

EXAMPLE

The group usually sings during work 3

If you estimated that this statement has rather low accuracy for your group in the past week, you would write a "3" in the space

---

EXAMPLE

There are a lot of personal friends among the group members 6

If you estimated that this statement has very high accuracy for your group in the past week you would write a "6" in the space.

Some people in the team are too smart to say what they really think. ______

We do a lot of bitching. ______

Somebody in the team is ready to give me a hand, even without my asking. ______

Some in the team do most of the work and others just share in the credit. ______

There is always a lot of talking and conversation in the team. ______

Some or another of the guys is always rubbing somebody the wrong way. ______

Some people in the team can push the others around. ______

There is a pretty good feeling between us here. ______

Everybody always pulls together to get a job done. ______

Some members of the team don't really know what they are here for. ______

It doesn't take much to get an argument started in the team. ______

The team needs fewer chiefs and more Indians. ______

This would be a better team if we could eliminate a few members. ______

Although the team does its work all right, there's not much friendliness here. ______

The team as a whole makes important decisions. ______

Some of the men are shirking their duty. ______

Some of the team think only of themselves, even on matters that affect everybody. ______

Not everyone has a clear idea of what he is supposed to be doing. ______

Members of the team work well together as a group. ______

I would rather be with my present team than with any of the other teams. ______

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very Low level	Somewhat Low level	Medium level	Somewhat High level	Very High level	Extreme level

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10 Jun' 60

2

Fig. 20.--Questionnaire B, page 2

PERFORMANCE

8. First: in any order, list the five members of your group. Then in the box after each name, write a number from the LEVELS scale which best shows your own personal estimate of each person's level of performance during the past few days.

PLEASANT

9. What aspect(s) of this past few days' regular duties and team activities have you personally found most pleasant and enjoyable?

UNPLEASANT

10. What aspect(s) of this past few days' regular duties and team activities have you personally found most unpleasant and distasteful?

LIKING

11. List the five members of your team in any order. After each name write a number from the LEVELS scale which best shows your own present level of liking for each person as a good friend.

12. List the five persons on your team in order according to their contributions of some very good (best) answers to team problems in the past few days.

PERFORMANCE

13. What changes in your group's performance have you noted during the past four or five days?

- ☐ STAYED ABOUT THE SAME
- ☐ GOT WORSE
- ☐ IMPROVED

SYMPATHY

14. Name the two persons who have been most helpful and sympathetic for you personally in the past four or five days.

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very Low level	Somewhat Low level	Medium level	Somewhat High level	Very High level	Extreme level

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3

Fig. 21.--Questionnaire B, page 3

15. In the spaces at the right, list the 5 other members of your group in order according to the amount of <u>weight and influence</u> the opinions and ideas of each have had on the group as a whole.

16. In any order, list the five other members of your group. In the box after each name, write a LEVELS scale number showing your own <u>level of preference</u> to have that person on another team with you again

LEVEL OF PREFERENCE

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very Low level	Somewhat Low level	Medium level	Somewhat High level	Very High level	Extreme level

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10 Jun' 60

Fig. 22.--Questionnaire B, page 4

Questionnaire C

QM Polar Project 60 - 1

Your Name____________________ Today's Date__________

Your Team____________________

1. The LEVELS scale appears at the bottom of this page. Listed in CAPITAL letters below are some things that may bother you or your teammates from time to time.

A. In the boxes below, write a number from the LEVELS scale to show your own personal level of annoyance & irritation with each of the different matters listed (during the past day or two).

B. The other on your team may not feel as you do. In the boxes below write a number from the LEVELS scale to show what you think is their general level of annoyance & irritation with each of the matter listed (during the past day or two).

A		B
☐	WEATHER CONDITIONS	☐
☐	WORK-SHARING	☐
☐	THIRST	☐
☐	SLEEPING CONDITIONS	☐
☐	SEX	☐
☐	FATIGUE & WEARYNESS	☐
☐	HEALTH	☐
☐	HUNGER	☐
☐	OVERHEATING	☐
☐	COOKING	☐
☐	SCIENTIFIC OBSERVERS	☐
☐	WATER-MELTING	☐
☐	THE OTHER TEAMS	☐
☐	PERSONAL UNCLEANLINESS	☐
☐	SELFISHNESS	☐
☐	COLD	☐
☐	OTHER__________ (specify)	☐

The LEVELS Scale:

1	2	3	4	5	6	7
Zero Level	Very Low Level	Somewhat Low Level	Medium Level	Somewhat High Level	Very High Level	Extreme Level

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June 16, 1960

Fig. 23.--Questionnaire C, page 1. This questionnaire focused mainly on personal phenomena emerging during the day or two previous to its administration.

CHEWING GUM

2. How do you personally feel that <u>chewing gum</u> affects your thirst? Check one of the statements at the right.

( ) Doesn't affect my thirst at all.
( ) Makes me <u>more thirsty generally</u>.
( ) Makes me <u>less thirsty generally</u>.
( ) Makes me <u>more</u> thirsty at first, but <u>less</u> thirsty later on.
( ) Makes me <u>less</u> thirsty at first, but <u>more</u> thirsty later on.

GROUP ATMOSPHERE

3. The LEVELS scale appears at the bottom of the page. In the box before each statement below write a number from the LEVELS scale to show your personal estimate of the <u>level of accuracy</u> of each statement for your team.

[ ] STRICTNESS
[ ] USING FIRST NAMES
[ ] PRAISING EACH OTHER
[ ] GETTING BREAKS FOR EACH OTHER
[ ] ASKING INSTEAD OF ORDERING
[ ] LOOKING OUT FOR EACH OTHER
[ ] CHECKING UP ON EACH OTHER
[ ] PLAYING FAVORITES
[ ] SETTLING ARGUMENTS
[ ] HELPING EACH OTHER

SMOKING

4. How do you personally feel that <u>smoking</u> affects your hunger? Check one of the statements at the right.

( ) Doesn't affect my hunger at all.
( ) Makes me <u>more hungry generally</u>.
( ) Makes me <u>less hungry generally</u>.
( ) Makes me <u>more</u> hungry at first, but <u>less</u> hungry later on.
( ) Makes me <u>less</u> hungry at first, but <u>more</u> hungry later on.

5. In the spaces at the right, list the five members of your team in the order which you personally feel they would make good leaders on another team next year.

GOOD LEADERS

____
____
____
____
____

POOR LEADERS

CHEWING GUM

6. How do you personally feel that <u>chewing gum</u> affects your hunger? Check one of the statements at the right.

( ) Doesn't affect my hunger at all.
( ) Makes me <u>more hungry generally</u>.
( ) Makes me <u>less hungry generally</u>.
( ) Makes me <u>more</u> hungry at first, but <u>less</u> hungry later on.
( ) Makes me <u>less</u> hungry at first, but <u>more</u> hungry later on.

KNOWLEDGE ABOUT OTHERS

7. In any order, list the five members of your team. In the box after each name, write a number from the LEVELS scale to show how you estimate you are well-informed about them (know most things about them).

____________________ [ ]
____________________ [ ]
____________________ [ ]
____________________ [ ]
____________________ [ ]

The LEVELS Scale:

1	2	3	4	5	6	7
Zero Level	Very Low Level	Somewhat Low Level	Medium Level	Somewhat High Level	Very High Level	Extreme Level

Fig. 24.--Questionnaire C, page 2

FOOD TALK

8. How do you personally feel that thinking about food (and listening to other talk about food) affects your hunger? Check one of the statements at the right.

( ) Doesn't affect my hunger at all.
( ) Makes me more hungry generally.
( ) Makes me less hungry generally.
( ) Makes me more hungry at first, but less hungry later on.
( ) Makes me less hungry at first, but more hungry later on.

INFORMAL ROLES

9. Listed below are nine different types of people that you will generally find in most groups. In the space after each type, write the name of one person among your teammates who best fits each description (include your own name if you think it applies).

ADVICE GIVER__________ MOST POPULAR__________

ARGUER__________ MOST SYMPATHETIC__________

JOKE-TELLER__________ REAL LEADER__________

COMPLAINER__________ SMARTEST__________

HARDEST WORKER __________

SMOKING

10. How much have you smoked today? ( ) Not at all.

________ cigarettes (number) ________ cigars (number) ________ pipefulls (number)

CHEWING GUM

11. How many of the wrapped pieces of gum have you chewed today?

________ (number) ( ) None

FOOD THOUGHTS

12. How much have you thought about food today? (Check one box.)

A GREAT DEAL	and more than yesterday	( )
	but less than yesterday	( )
MODERATELY	and more than yesterday	( )
	but less than yesterday	( )
VERY LITTLE	but more than yesterday	( )
	and less than yesterday	( )

TRAIL POSITIONS

13. Three trail positions (trail-breaking, sled-hauling, and following) are rotated among team-members on the trail. In the boxes below, write a number from the LEVELS scale (at bottom of page) to show your personal feeling about the level of difficulty of each of the three trail positions.

TRAIL-BREAKING ( ) SLED-HAULING ( ) FOLLOWING ( )

HOURS

14. At what time of day during the past few days have you been most tired?

________ (time of day)

At what time of the day during the past few days have you been the most hungry?

________ (time of day)

15. Write a number from the LEVELS scale to show your own level of tiredness today. ( )

Write a number from the LEVELS scale to show your own level of hungryness today. ( )

The LEVELS Scale:

1	2	3	4	5	6	7
Zero Level	Very Low Level	Somewhat Low Level	Medium Level	Somewhat High Level	Very High Level	Extreme Level

Fig. 25.--Questionnaire C, page 3

Post ~~Pre~~-Questionnaire

____
(Your name)

Introduction:

During this exercise you are expected to help judge whether the procedures being used are working out all right or not. In this situation it is necessary to know something about the people doing the judging. The purpose of this questionnaire is to enable you to report your general attitudes and feelings about the exercise and about other people you may be working with.

1. At the bottom of this page is a LEVELS scale. Look at it carefully. Then, in the boxes which precede the statements below, write a number from the LEVELS scale which best shows your own personal level of agreement with each statement.

a ( ) Human nature being what it is, there must always be war and conflict.

b ( ) The most important thing a child should learn is obedience to his parents.

c ( ) A few strong leaders could make our country better than all the laws and talk that goes on.

d ( ) Most people who don't get ahead just don't have enough will power.

e ( ) Husbands should help their wives with the dishes and help care for the children.

f ( ) Women should stay out of politics.

g ( ) A person should not forgive or forget an insult to his honor.

h ( ) People can be trusted.

2. At the bottom of this page is a LEVELS scale. In the box at the right, write the number from the LEVELS scale which best shows your own personal present level of interest toward ~~going~~ being out on this Greenland Icecap operation for the ~~next~~ last seven weeks.

3. Twenty-eight EM's ~~have been~~ were selected for this operation. At the right list the last names of four men who you think ~~will be~~ were the most observant and critical judges of good and bad points about supplies, equipment and procedures.

1.__________________
2.__________________
3.__________________
4.__________________

The LEVELS scale:

1	2	3	4	5	6	7
Zero level	Very low level	Somewhat low level	Medium level	Somewhat high level	Very High level	Extreme level

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26Jun'60

Fig. 26.--Pre- and Post-Questionnaire, page 1. This questionnaire focused on subjective and social aspects of the experiment as a whole. The post-experiment form is shown with modifications of tense written in. The same questionnaire, unmodified, was administered before the beginning of the experiment.

4. As you know, 5-man teams (4 E.M.'s and one NCO) ~~will be~~ were formed to work together. List the last names of four men you would pick to make up the 5-man team you would most prefer to be on.

1__________ 2__________ 3__________ 4__________ 5__________

---

5. a. At the right, list names of four men, from among the 28 E.M.'s, who you suppose might be expected to perform quite well by themselves on the Icecap under most conditions.

1.__________
2.__________
3.__________
4.__________

5. b. Now list the names of four men from among the 28 E.M.'s who you suppose might not perform quite so well by themselves on the Icecap under most conditions.

1.__________
2.__________
3.__________
4.__________

---

6. a. At the right, list names of four men from among the 28 E.M.'s, who you think may tend to be usually more considerate, affectionate and helpful towards others.

1.__________
2.__________
3.__________
4.__________

6. b. In the spaces just below, list names of four men, from among the 28 E.M.'s, who you think may tend to be usually less considerate, affectionate and helpful towards others.

1__________ 2__________ 3__________ 4__________

---

7. a. Name four men, from among the 28 E.M.'s who seem most quiet and least talkative.

1.__________
2.__________
3.__________
4.__________

7. b. Now in the space below name the four men, from among the 28 E.M.'s, who seem most talkative and least quiet.

1__________ 2__________ 3__________ 4__________

2

Fig. 27.--Pre- and Post-Questionnaire, page 2

8. At the right, list the names of four men, from among the 28 E.M.'s, who you think may ~~become~~ are most popular and well-liked during the six-week operations.

1. ______
2. ______
3. ______
4. ______

9. a. Some people resemble each other because they tend to like to do similar things and to have the same interests, beliefs and backgrounds. Name the four men, from among the 28 E.M.'s who you would consider possibly most similar to yourself.

1. ______
2. ______
3. ______
4. ______

9. b. Now, in the spaces below name four men, from among the 28 E.M.'s who you consider possibly least similar to yourself.

1 ______ 2 ______ 3 ______ 4 ______

10. Finally, name the four men from among the 28 enlisted men whom you feel you know <u>least</u> about and whom you feel you know least well.

1 ______ 2 ______ 3 ______ 4 ______

11. Please give the following information:

a. Your age ______

b. Your father's regular occupation during most of his working life ______

c. Name of the state you lived in mostly before age 16 ______

d. Number of years you went to school ______

e. Before age 16, were you living mostly in cities or mostly in small towns and the country?

______ Cities ______ Towns & Country

f. What are the ages of your living brothers and sisters (if you have any)?

______ none

g. Number of years you have been in the Armed Forces ______

h. Number of years your father went to school ______

3

Fig. 28.--Pre- and Post-Questionnaire, page 3

QM Polar Research
Project 60-1

FOOD QUESTIONNAIRE

Name________________________ Cycle______________

Group_______________________ Date_______________

This questionnaire is designed to get information about the ration you have been using. We are interested in each person's own opinions and experiences. Therefore, in answering the questions on the following pages, you are urged to give your own ideas, and to say what you like and don't like. Don't worry if somebody else doesn't agree with you - there are no right or wrong answers.

Please do not discuss the questions with anybody else while filling out the questionnaire.

1. First, we would like to know how much you liked or disliked each of the foods in the ration. Give this information by using the rating scales on the following pages. All of the foods in the ration you have been using are listed. Consider each one in turn and indicate how much you liked or disliked it by circling one of the phrases to the right. If you did not eat a food during the cycle, circle "Not Tried" to the left of the food name.

Fig. 29.--Food Questionnaire, page 1. This questionnaire focused on the rations used during the experiment.

X		9	8	7	6	5	4	3	2	1
not tried	Chicken	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Jam	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Cocoa	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Ham & eggs	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Peaches	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Vanilla cream disc	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Tuna and noodles	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Apricots	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Beans with frankfurters	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Sweet chocolate disc	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely

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Fig. 30.--Food Questionnaire, page 2

X		9	8	7	6	5	4	3	2	1
not tried	Ham & Potatoes	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Pecan roll	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Pork steaks	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Coconut disc	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Pears	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Pineapple	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Pound cake	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Peanut butter	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Vanilla cookies	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Crackers	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely

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3

Fig. 31.--Food Questionnaire, page 3

X		9	8	7	6	5	4	3	2	1
not tried	Chocolate cookies	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Gum	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Bread	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Beef & peas	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Coffee	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Beef steaks	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Fried ham	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Chocolate fudge disc	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Turkey loaf	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely
not tried	Spiced beef	like extremely	like very much	like moderately	like slightly	neither like nor dislike	dislike slightly	dislike moderately	dislike very much	dislike extremely

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4

Fig. 32.--Food Questionnaire, page 4

2. Were there any foods which you particularly disliked? If so, please list them below and briefly state, for each one, why you didn't like it.

3. (a) On the whole, did you get tired of the ration or did you continue to like it about the same throughout the period?

GOT TIRED OF IT LIKED IT ABOUT THE SAME

(b) What particular foods, if any, did you like at first but got tired of later? List below.

4. In your opinion, how good is this ration for the conditions under which it is being used?

VERY GOOD GOOD FAIR POOR VERY POOR

5

Fig. 33.--Food Questionnaire, page 5

5. (a) How often were you hungry during this cycle?

NEARLY ALL THE TIME	VERY OFTEN	OFTEN	JUST A FEW TIMES	NEVER

(b) What time of day were you usually hungriest?

6. (a) How often did you have trouble in getting enough liquids to drink?

OFTEN AT CERTAIN TIMES NEVER

(b) If so, when did this happen?

(c) How much plain water did you drink?

QUITE A LOT SOME VERY LITTLE NONE

7. At any time during this cycle did you have any physical symptoms or distress which you feel was caused by the foods or beverages? If so, briefly describe in the space below. If not, write "none."

6

Fig. 34.--Food Questionnaire, page 6

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