

RELATIVE DESIRABILITY OF LEISURE  
ACTIVITIES AND WORK PARAMETERS  
IN A SIMULATION OF ISOLATED  
WORK STATIONS

by

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## TABLE OF CONTENTS

ACKNOWLEDGMENTS .....	ii
OTHER PUBLICATIONS .....	iii
INTRODUCTION.....	1
METHODS .....	6
RESULTS .....	23
CONCLUSIONS AND DISCUSSION .....	41
APPENDIX	

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## OTHER PUBLICATIONS

Walter R. Sullins, Jr. and Jon G. Rogers, The impact of confinement studies on environmental planning and design. Proceedings of the 16th Annual Meeting of the Human Factors Society, 1972. pp. 11-13.

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Jon G. Rogers and Walter R. Sullins, Jr., Payload Carrier Simulator Man/Systems Program Integration, Final Report, Phase B, Volume II. NASA Contract NAS8-28512, August, 1973, 101 p.

As man ventures into new domains made accessible by his growing technology, he finds it often necessary to leave behind, during his venture, the comforts of home and his ordinary, well understood style of life. For a time, he assumes a life style seemingly as uncharted as the adventure itself. Security is often derived from the fact that it must always have been so. Since the times of the ancients, many men must have survived in good health to tell their tale of adventure. In the telling and retelling of those tales, however, lies always the thread of a curious enigma. Alongside the magnificent excitement of the strange world he ventured into, the trivia of a man's adaptation to an unusual life style during his voyage seems prosaic indeed. In his song of the adventurer's strange view from the edge of the world, what bard will sing of the stale peas or drab quarters?

So it is, then, that books are filled with the chartings of the unknown, the road maps to new worlds and their waiting riches, but scarcely a page is to be found about how the adventurer should prepare himself for daily life during the journey. What paragraphs there are speak of nature's chilling assault upon man; the cold, the wind, the darkness, the vacuum, the alpha, beta, gamma, delta, and mega rays. Far more satisfying it is to tell of the great adventurer's conquest of these wild forces, than to admit that, even he, longed for a minstrel's song during his voyage.

Obviously contemporary man is planning similar ventures in the imminent future, in space, under the sea, and perhaps more important, in the restructuring of his everyday ecological niche on the Earthship. Just as obviously, he will, as always, concentrate most intensely on the mission's goals, and the preparations for the savage onslaught of physical forces. As always, he will be making his plans based on an imperfect knowledge of the ways his strange life-style during the voyage may impact his effectiveness and enrichment during an arduous and expensive adventure. When, as today, such ventures are planned by an affluent society, in the context of complex life-styles, it is not surprising that the suspicion might develop that such an impact might exist, and might be important. In what ways do working conditions, time lines, decor, procedures, leisure provisions, variety and quality of food, etc., affect the man himself, thereby altering both his effectiveness for accomplishing the mission's goals and his own enrichments from the venture? Or is there really any appreciable effect at all? At the very least, we begin to feel, the latter question should be addressed!

Within the contemporary archives of research there are a number of studies of man in those kinds of unique settings that usually include some degree of "isolation." For a succinct

description of many such isolation studies the document Crew Interaction in Situations Simulating Long Term Space Flight, by the Sciences Communication Division of the George Washington University Medical Center, is recommended. Most of these experiments and/or studies within live missions, were focused on devices and procedures either for mission accomplishment, or for survival in hostile physical conditions. The experimental conditions of others were set to test man's adaptation to the unlikely condition of extensive deprivation of work and stimulation. Most do, however, contain at least some informal information about the impact of work/leisure/living conditions upon the crewmen. The current literature permits some reasonably confident conclusions about isolation situations which include meaningful work.

1. Leisure facilities and provisions, when provided, are used. There are suggestions of a relatively stable hierarchy of value among various types of leisure provisions.
2. Certain characteristics of the available food, beyond its simple edibility and nutritional adequacy, seem very important. These characteristics, though not well defined, probably include appropriateness, variety, and freedom of choice.
3. Some facilities for ordinary living activities, such as sleep, hygiene, exercise, and housekeeping, appear to have a detrimental

effect if they are inadequate.

4. Procedural variables such as schedules, deadlines, operating procedures, instructions, etc., may vary in adequacy and rigidity, and such variations have a notable effect on subjects or crewmen.

5. Attempts to have subjects or crewmen participate in intrusive measures of their activities, performance, or state are met with resentment and singular lack of effectiveness. Currently there are few relevant, non-obtrusive objective measures available.

6. There is frequently a notable discrepancy between the things subjects or crewmen say are important and the degree of importance inferred from more objective measures, such as extent of actual use. Some question is thus raised about the value of subjective reports.

In the light of this partial list of summary conclusions, the research reported here was undertaken to further examine a limited set of questions.

The Man/System Integration studies of the Sealab program, coordinated by Deutsch and reported particularly by Watters and others in the volume Scientists In The Sea had yielded an initial delineation of the kinds of activities that are attractive to man in isolation. These data were drawn from the crewmen's verbal evaluations and from observations of the amount of time the crewmen



were engaged in various optional non-working activities. An independent series of experiments in the University of Alabama Isolation Research Laboratories had produced strikingly similar results.

The NASA and UAH experiments were similar in that the subjects or crewmen in both were expected to do a substantial amount of work during isolation, and were provided with optional leisure provisions. The experiments differed in three major respects. The NASA missions were real, with attendant real stress and danger, while the UAH experiments occurred in a reasonably safe laboratory. The NASA missions isolated small groups of men together, the UAH studies isolated individuals alone. The data from the UAH studies was derived from the subjects actual purchase of leisure options within a closed micro-economic system. The finding that subjects selected essentially the same kinds of leisure options whether they were "free" or had to be "paid for" suggested that the extension of these laboratory studies to also include the relative value of decor and furnishings and other conveniences might be productive. It further appeared that these or very similar experiments could serve as a reasonably economical test bed for continued evaluation of data collection techniques devised for the Sealab experiments, and for the development of

additional non-intrusive data collection and analysis schemes.

### METHOD

There were two semi-independent sets of experiments. Within the set of "individual" experiments there were four experiments, each of which included two subjects individually isolated for five continuous days. There were three experiments within the "group" set, in which a small group shared a common space during isolation. In the first of these three experiments the group included three people isolated for seven days. The groups in the remaining two experiments included four people for nine days.

Major similarities between these two types of experiments included the use of meaningful work as a major activity for the subjects, and the availability of a very large variety of leisure/living provisions. The dependent variables were primarily concerned with the relative distribution among various work, leisure, and living activities in an isolation setting where external constraints on the subjects' freedom of choice among these activities were minimized.

### INDIVIDUAL EXPERIMENTS

Each subject was isolated from the other subject and from the control room in an 8 foot by 10 foot room. Each of these rooms contained a core of general equipment, such as speakers for music,

air-conditioner and heater, television set, lights, and control/communication console. All of these facilities were operated from the control room, and small objects such as work materials, books, and food were passed into and out of the room through a buffered port.

As a consequence of this configuration, the primary control of work/leisure/living activities resided in the control room and could be linked, via a set of rules, back to the subjects. This set of rules was designed to form a closed micro-economic system. Work done by the subjects on a set of programmed learning materials was translated at a constant rate into artificial economic units (called BITS), which were deposited into a bank account, displayed on his console. These BITS were in turn used to acquire any options desired from the entire spectrum of available leisure/living provisions. With few exceptions, the price of each option was based exclusively on the duration of use of that item or activity. Thus, 30 minutes of light, 30 minutes of music, or 30 minutes with a book all cost the same.

The net result of this closed economy with a common price base is that it required subjects to "put their money where their mouth was," so to speak. The choice among options could then reflect the relative actual value of those options to the individuals.

A further advantage of this design was that the individual isolation reduced the contamination of one person's choices by the whims and preferences of others. The goal of the experiments within this design was to ascertain the individual's priorities among various leisure/living options by examining his relative allocation of his resources among them. The major categories of options included:

1. Enhancement of decor and furnishings beyond a very minimal setting.
2. Accessories for convenience in work, hygiene, and housekeeping.
3. Optional characteristics of food, including amount, quality, and freedom of choice.
4. Choice among his own individualized clothing beyond the free "lab issue" clothing.
5. CCTV view of the control room.
6. Telephone communication with the other subject or control room.
7. Leisure options, including:
  - a) music
  - b) reading material
  - c) games, hobbies, and puzzles
  - d) movies
  - e) commercial television

8. Provisions for normal living, including:

- a) lights
- b) temperature control
- c) toilet and/or shower and/or sink
- d) mattress and/or pillow and/or blankets

SUBJECTS (INDIVIDUAL EXPERIMENTS)

Eight males, between the ages of 24 and 35, all of whom were college graduates with excellent academic records, were selected to match behavioral characteristics of successful aquanaut scientists. This matching was partially based on their scores on the 16PF Inventory and the Helmreich Life History Questionnaire and partially on their interest and participation in active outdoor activity as indicated in an intensive interview. All were in apparent excellent health, and were screened via the Minnesota Multiphasic Personality Inventory for assurance of sound mental health. Each participated in an intensive two hour briefing session the day before the experiment began. Pay for participation in the 5-day experiment was \$200.00.

APPARATUS (INDIVIDUAL EXPERIMENTS)

The two rooms in which individuals were confined were each 8' wide, 10' long, and 10' high, with the door located in one of the short sides. The floors were plain asphalt tile, all walls were

covered with 3 cm slightly irregular sheets of tan foam rubber and the ceiling was very dark brown 3 cm thick cork. The door contained a buffered port just large enough to exchange a tray of food. There were four 150 watt light fixtures mounted symmetrically on the ceiling; their intensity was set from the control room. A set of good fidelity speakers was mounted 7' high on the wall opposite the door. Signals for the speakers originated from high fidelity stereo equipment in the control room. Against the wall below the speakers was a sturdy 7' x 16" table. On this table rested the TV set, intercom, music amplifier, control console, and desk type work lamp. Power for the 12" black and white television set was switched in the control room, as were the CCTV signals from a camera in the control room, and from a video tape recorder on which movies were played. The intercom system was for use in the case of failure of the primary communication system. The primary system permitted the subject to speak into a hand held microphone with a built in hand switch, and to hear via the earphones or speakers of the music system. This system was interconnected with telephone operator's headsets in the control room. The control console included a four digit illuminated display, labelled "bank account," also operated from the control room. A group of pilot lights on the console were labelled "port", "bathroom", "OK to

open door", "material due back", and "telephone." The work lamp, when turned on by the subject while working, operated a running time clock in the control room. Electronic temperature control units in the control room could, by switching a portable heater and wall mounted air-conditioner, maintain any selected temperature from 65° to 95°F within  $\pm 1.5^\circ$ . Each room also contained a TV camera, in an upper corner, and a small suspended microphone. Both rooms were located on one side of a 5' wide hallway, one end of which opened onto a small bathroom, so that it was possible to go from either room to the bathroom without any exposure to the control room. The bathroom contained a chemical toilet, a sink and a shower. Availability of water for the sink and shower was provided from the control room.

The materials provided for work during isolation were ten different short courses prepared in programmed learning format for commercial use by the American Management Association. The titles and lengths of these courses are shown in Table I. These courses were designed for managerial personnel with supervisory responsibilities and were selected for use in these experiments as reflecting future, if not immediate, vocationally relevant education for the kinds of subjects selected for the experiments.

The materials available for selection as leisure/living options are summarized in Table II. All items were kept on hand for immediate delivery, except for natural foods which were obtained, when ordered, from local restaurants. The complete itemized listing of the approximately 1778 options, with their prices and code numbers was maintained on Rolodex card files, with one complete copy in each subject's room. The operator's manual, available to each subject, contained a table of contents of the card file, as well as operating instructions for all equipment, and a description of rules and procedures.

#### PROCEDURE (INDIVIDUAL EXPERIMENTS)

Each subject was required to read the operator's manual before the two to three hour briefing session. This session, held the day before the experiment began, included an opportunity for familiarization with all materials and procedures, particularly with those concerning work. Isolation was begun at 8 a.m. of the first day of the experiment. After the first hour, and until 8 a.m. of the sixth day, all activities fell within the boundaries of the economic system.

The structure of the economic system provided a constant ratio between the amount of work done and the available leisure/living options. The programmed learning courses used for work were subdivided into units, each calculated to require about one



TABLE I  
PROGRAMMED LEARNING COURSES AVAILABLE TO SUBJECTS

COURSE TITLE	TIME REQUIRED	BITS AVAILABLE
Making the Computer Work for Management	4.35 hrs.	4,882
Computing Systems Fundamentals: Vol. 1 & 2	11.15 hrs.	12,511
Writing Reports that Work	6.83 hrs.	7,667
Budgeting for Production: A Planning and Control System	5.60 hrs.	6,284
Physical Distribution Management	6.96 hrs.	7,817
Making Reliable Decisions with Linear Programming	5.98 hrs.	6,713
Sales Budgeting: A Planning and Control System	8.53 hrs.	9,573
Direct Costing: Key to Dollar Decisions	8.13 hrs.	9,124
Basic Statistics for Managers: Defining Critical Data	5.72 hrs.	6,913
Statistical Concepts for Managerial Decision Making	3.85 hrs.	4,320

TABLE II  
ACTIVITIES AND ITEMS AVAILABLE TO SUBJECTS

NUMBER OF ITEMS IN CLASS	CLASS OF ACTIVITY OR ITEM
	<b>ENVIRONMENT</b>
	<b>MAINTENANCE AND HYGINE</b>
1	Room Decorations Catalog
36	Room Furnishings
10	Lights
11	Temperature
6	Bathroom
1	Clothing
3	Sleeping Material
1	Exercise
	<b>WORKAIDS</b>
42	Work Materials
	<b>ENVIRONMENT MISCELLANEOUS</b>
4	Incense and Air Fresheners
7	Cleaning Materials
	<b>COMMUNICATIONS</b>
2	Telephone
3	Closed Circuit Television
2	Telephone and Closed Circuit Television
3	Privacy
1	Neutral Room
2	Wake-Up Calls

TABLE II (Continued)

NUMBER OF ITEMS IN CLASS	CLASS OF ACTIVITY OR ITEM
	<b>ACTIVITIES</b>
	<b>ACTIVITIES</b>
26	Games and Toys
14	Hobbies and Crafts
4	Musical Instruments
	<b>PERIODICALS</b>
3	Newspapers
30	Magazines
14	Pornographic Magazines
37	Comic Books
	<b>BOOKS</b>
	<b>POETRY, PLAYS, SHORT STORIES</b>
18	Poetry
7	Plays
28	Short Stories
	<b>MYSTERIES AND WESTERNS</b>
11	Mysteries
27	Westerns
	<b>SCIENCE FICTION</b>
26	Science Fiction
	<b>MISCELLANEOUS FICTION</b>
90	Miscellaneous Fiction

TABLE II (Continued)

NUMBER OF ITEMS IN CLASS	CLASS OF ACTIVITY OR ITEM
	<b>ASSORTED NON-FICTION</b>
14	Pornographic Books
8	Photographic Books
2	Bibles
8	How-To-Do Books
2	Outer Space and Extra-Terrestrial Life
	<b>EDUCATION</b>
11	Philosophy Books
13	Political Books
9	Psychology Books
9	Religion Books
	<b>OTHER NON-FICTION</b>
9	Social Comment
4	Travel
3	Witchcraft
5	Women's Liberation
8	Sex Books
20	Miscellaneous Non-Fiction
	<b>VISUAL</b>
1	Commercial Television
3	Pornographic Slides (Sets of 60)
17	Pornographic Movies
1	Pornographic Movies with Sound
10	Entertainment Movies with Sound

TABLE II (Continued)

NUMBER OF ITEMS IN CLASS	CLASS OF ACTIVITY OR ITEM
	MUSIC
310	Rock
142	Classical
51	Country
94	Easy Listening
9	Electronic
79	Folk
60	Jazz
18	Comedy and Readings and Strange Things
17	Show Tunes and Sound Tracks
5	Music Control Options
	FOOD
	RECONSTITUTED
	MENU MEALS
5	Breakfast
5	Lunch
5	Dinner
16	Snacks
19	Drinks
	FREE CHOICE MEALS
14	Breakfast
18	Lunch
18	Dinner

TABLE II (Continued)

NUMBER OF ITEMS IN CLASS	CLASS OF ACTIVITY OR ITEM
	REAL FOOD
	MENU MEALS
5	Breakfast
5	Lunch
5	Dinner
28	Snacks
18	Drinks
6	Beer and Wine
	FREE CHOICE MEALS
20	Breakfast
78	Lunch
73	Dinner
12	Alcoholic Drinks
	MEDICINE AND TOBACCO PRODUCTS
13	Medicine
3	Tobacco Products

hour to complete. A short test was provided for each unit. The subject selected a course and unit, and after working that unit, if he passed its test, received an increment to his bank account. The size of the increment was determined by the adjusted expected time required to work that unit, and averaged 18.7 ( $\pm 4\%$ ) economic units, or BITS, per minute of working time. Subjects turned on their work lamps only while working, so that a precise ( $\pm 2\%$ ) record of working time was available from the running time meters. There were no constraints on the time of day that work could be done, or on the conditions under which it was done.

Subjects could select and order any of the leisure/living options at any time, with the exception of certain food and furnishings options described below. At the time of the order the bank account was decremented by the cost of the option. The standard cost base was one BIT for each minute of use. The requested duration of the option was specified at the time of the order, except in cases where the option had a fixed duration, such as an album of music. Thus, if a book was ordered for 45 minutes, the cost was 45 BITS.

Requests for options were made via the primary communication system following a brief, standard protocol. Most items were delivered immediately after being ordered. Small physical items were placed in the port, large items in the hallway by the door of

the room. Other options such as lights and music were simply turned on. Permission was given to go to the bathroom via one of the pilot lights on the console.

There were three types of exceptions to the general procedures and prices for leisure/living. Each of these was included to provide particularly unique data points.

1. Music could be ordered over either speakers or earphones, the question being whether music over the speakers was notably more valuable. Earphone music was thus priced at 1 BIT per minute, while speaker music cost 1.5 BITS per minute.
2. Decor and furnishing options were included in a secondary experiment to ascertain whether initial conditions would affect the value of such options. Two pairs of subjects spent the first two days of the experiment in the minimal furnishing and decor condition, which consisted of bare tile floor, walls covered with irregular pieces of non-decorous foam rubber, very meager furniture, and no decorations. Beginning on the morning of the third day, each of these four subjects could purchase, for successive 24 hour increments, various



combinations of physical enhancements. The following items were not mutually exclusive, any combination could be selected, but the costs were additive, with the price of each item being 1080 BITS per 24 hour increment (9 BITS per minute X 18 hours.)

ITEM A Carpet for 24 hours.

ITEM B Drapes on four walls for 24 hours.

ITEM C Comfortable, large, reclining executive desk chair for 24 hours.

ITEM D A selection of colorful paintings, plants, mobiles, etc., for 24 hours.

In the other experimental condition (with furnishings) the remaining four subjects spent the first two days in rooms fully outfitted with the above items, without cost. Beginning with the morning of the third day, these subjects were required to purchase, or lose, these items in the same way as subjects in the non-furnishing condition.

In all cases where such items were ordered, they were installed while subjects were in the bathroom.

3. Food options were part of a secondary experiment

to examine the relative importance of varying degrees of freedom of choice of food. The basic rationale for the determination of food prices was the number of minutes worth of calories in a food item. From a standard value of 1.69 calories per minute (1.69 calories per BIT) the BIT costs were modulated  $\pm 25\%$  by the actual money price of the item. Thus, the average price of food was .59 BITS per calorie, but the cost of each item was partially a function of its money price. The modulation itself was based on the item's deviation from the average money price per calorie of the entire list of foods available to the subjects. In addition to the selection of individual food items, the subjects were required to select the type of food and degree of choice available during each day. The following four possibilities were available:

ITEM A A pre-programmed menu of frozen and reconstituted foods for the ensuing 24 hour day. (This choice

itself cost 0 BITS).

ITEM B Free choice among a large list of frozen and reconstituted food during the ensuing 24 hour day. (This choice itself cost 409 BITS).

ITEM C A pre-programmed menu of natural and restaurant food for the ensuing 24 hour day. (This choice itself cost 409 BITS).

ITEM D Free choice among a large list of natural and restaurant foods during the ensuing 24 hour day. (This choice itself cost 818 BITS).

The time of day some foods could be ordered was limited to the hours restaurants they were obtained from were open.

Exercise was required for at least 5 minutes three times each day. The Mood Adjective Checklist was filled out twice each day, in the early afternoon and during the evening. A Habitability Assessment Rating Scale and Environmental Assessment Form were filled out during the fourth and fifth evenings respectively. On the morning of the sixth day the subjects underwent a relatively

structured debriefing before leaving.

## GROUP EXPERIMENTS

### EXPERIMENTAL DESIGN

The primary purpose of the three group experiments was to provide a test bed for the development and evaluation of non-intrusive techniques for the acquisition of pertinent data from future isolation studies. Of particular interest were techniques relevant to man-in-space simulation studies. For this reason the design of the previous individual studies was modified and simplified considerably to provide a more direct and apparent simulation of major characteristics of the man-in-space situation. Subjects were isolated together in small groups, (3 in the first experiment, four in the other two.) Work was made independently meaningful or important by providing a programmed version of a university level course which subjects could complete for credit and a grade during confinement. An equally large number and variety of leisure/living provisions were made available, but they were directly accessible to the subjects at all times and could be used independently of work. With an increase in the available space to include three rooms, a hall, galley, and head, the isolation facility was made almost entirely self sufficient and independent. The exceptions were passing course tests and laundry

between the subjects and control room and the necessity of restocking the groceries midway in the experiment.

The subjects worked throughout the experiment to accomplish the tasks related to the programmed course, using the leisure/living provisions whenever and however appropriate to sustain general productivity and satisfaction. During the experiments various data gathering schemes were introduced, and their data examined between experiments. A secondary, but important goal for these experiments was also the acquisition of data related to the same points as in the individual experiments. In this respect, the group experiments provided a comparison of the priority of activities in group versus individual environments.

#### SUBJECTS (GROUP EXPERIMENTS)

The eleven subjects (three in the first and four in the remaining two experiments) ranged in age from 18 to 40 years. All were university students who needed or wanted the statistics course for credit. They were drawn from all four years of college and their grade averages ranged from C+ to A, with an average of B. All were in apparent good health and were screened via the MMPI for an acceptable degree of mental health. They were extensively interviewed before selection. The goal of the selection procedure was to select a sample that was heterogeneous with respect to a variety of characteristics, rather than to match the characteristics

of any target population. They were fully informed as to the nature, purpose, and procedures of the experiments before signing informed consent forms. Each was paid \$250.00 for participation in the experiment.

#### APPARATUS (GROUP EXPERIMENTS)

The isolation facility included two general purpose rooms, a work room, head, galley, and hallway. All activities in each of these areas, except the head, could be continuously observed via CCTV cameras and a multiple microphone system. The work room (88 ft<sup>2</sup>) was brightly decorated in white, red, and black. It contained a large table with secretary's chairs, 250 ft. of bookshelves, calculators, reference books, and other work aids, intercom and music speakers. The library of books and magazines and the games, hobbies, and crafts were located on the shelves in this room. The two general purpose rooms (88 ft<sup>2</sup> each) were well isolated acoustically and were quietly decorated in a tan motif including drapes on all walls and carpet. They contained black and white TV sets, high quality stereo music systems, large and small chairs. Light and temperature controls for these rooms were located in the hallway. The head (28 ft<sup>2</sup>) included a shower, sink, small electrical fresh water toilet, a toiletries cabinet, and 21 ft. of shelf space on which linens were stored. The galley (30 ft<sup>2</sup>) contained a

microwave oven, small toaster oven, 40 ft. of shelves on which was stored a complete set of cooking and eating utensils. The hallway (78 ft<sup>2</sup>) was crisply decorated in yellow and green. The door to the control room contained a buffered interlock for the exchange of small items and garbage ejection without exposure to the control room. It contained an intercom, freezer, refrigerator, and some small shelves for music tapes and food.

As the core of the work materials each subject was provided with a copy of the set of volumes Psychological Statistics published by Individual Learning Systems, and a copy of Fundamentals of Behavioral Statistics by Runyan and Haber. These volumes cover an entire college level course in statistics. Also available were two electronic calculators, and a set of various additional statistics texts with a cross reference list to guide the subjects to additional material and exercises for each concept. A set of unit tests was provided, one for each unit in the programmed sequence, and a set of final exams to be passed in during the last day of the experiment.

All of the leisure/living options available for the individual experiments, as summarized in Table II, were available except a few of the decor items, the food, and clothing. The entire isolation chamber was outfitted throughout the experiment with a moderate level of decor, including some pictures, plants, and mobiles.

Subjects wore their own clothes with no restrictions. Groceries sufficient for the first 5 days were stocked in the isolation area and prepared by the subjects. The selection of groceries was based on lists prepared by the subjects.

#### PROCEDURE (GROUP EXPERIMENTS)

After selection, each subject completed the MMPI, 16PF, and Edwards Personal Preference Survey. One week before the experiment each was given a copy of the operator's manual, and began filling out TASK (Time Allocation Sample Key) forms once each day. (A TASK form and instructions are found in Appendix A.) During the week before the experiment they were thoroughly briefed on procedures and equipment, and particularly about techniques and procedures for the statistics course. They were isolated at 8 a.m. of the first day. There were no constraints imposed on their use of time, space, or provisions during the experiment, this point was heavily stressed during the briefings. As each unit of the programmed text was completed, the unit tests were scored by the control room and appropriate feedback related to errors was provided. The subjects were strongly encouraged to work together during their study of the units. The final exams were worked during the afternoon of the last day and grades were announced after the exam was scored. TASK forms were filled out



once each day, usually at bedtime. On the morning of the tenth day, (eighth day of the first experiment) each subject individually participated in a free form, nondirective debriefing, after which they all left. TASK forms were filled out once each day for the next week.

The major source of data from the group experiments was a Binary Interval Time Sampling technique. Observers recorded, in considerable detail, the location and activities of each subject every six minutes throughout the experiment. This technique was fully described in the report Payload Carrier Simulator Man/Systems Program Integration, Phase B, Volume II, by Rogers, J. G., James, R. E. and Sullins, W. R. This volume was a final report submitted to the National Aeronautics and Space Administration, George C. Marshall Space Flight Center.

## RESULTS

### WORK

In both the individual and group experiments all subjects did an appreciable amount of successful work. The average percent of waking hours spent working was 32% in the individual experiments and 42.5% in the group experiments. In both sets of experiments more work was done during the early days of isolation with a steady decline from day one among the individual subjects, (Table III), and

TABLE III  
TOTAL NUMBER OF BITS EARNED BY WORKING PROGRAMS  
FOR EACH DAY FOR EACH SUBJECT

SUBJECTS	DAYS					TOTAL
	1	2	3	4	5	
A1	5967	5143	8227	6376	916	26,629
B1	6654	7508	6765	7313	2023	30,263
A2	6621	5230	5698	5016	7392	29,957
B2	9615	8074	6497	3145	3324	30,655
A3	10051	7405	1909	2262	2831	24,458
B3	9722	8281	7564	7362	7020	39,949
A4	5855	6751	7463	10829	5777	36,675
B4	5983	7762	5077	3235	1346	23,403
TOTAL	60,468	56,154	49,200	45,538	30,629	241,989

a similar decline after the fifth day for the group subjects (Table IV). As may be seen in these tables, this mean trend is not an accurate description of most of the individuals, though it is more descriptive of the group experiment people. In both cases the peak work day varied widely among individuals, even though the general conditions were nearly the same for all individuals within one or the other of the experiments. So far, no predictive measure for this variation has been identified.

Fig. 1 and Fig. 2 indicate that the greatest average amount of work was done between the hours of 11 a.m. and 7 p.m. with some work continuing until midnight in both experiments. Again, however, these average averages do not effectively describe any specific individual on any given day. Visual inspection of the raw data suggests that relating work done to hours after waking might be more descriptive. In the case of both day of isolation and time of day work is done, the most notable trend is perhaps the large individual variation. This is, of course, directly related to the fact that there were no imposed timelines or schedules in either experiment.

Various measures of amount and effectiveness of work are compared in Table V and Table VI. In neither experiment were these two characteristics found to be directly related. The correlation coefficients relating time worked to efficiency (amount per unit time) were  $-.19$  in the individual experiment and  $-.73$  in the group

TABLE IV  
HOURS PER DAY SPENT WORKING BY  
SUBJECTS IN GROUP EXPERIMENTS

DAYS	SUBJECTS											MEAN
	G11	G12	G13	G21	G22	G23	G24	G31	G32	G33	G34	
ONE	5.7	3.3	4.4	9.0	8.7	8.4	8.4	9.1	8.9	8.4	8.7	7.5
TWO	10.3	8.3	5.8	6.7	6.9	6.5	6.8	8.3	7.9	5.9	8.3	7.4
THREE	12.2	8.5	5.8	4.2	4.4	4.6	4.1	7.4	8.4	5.6	7.2	6.6
FOUR	10.8	6.5	6.5	7.4	7.7	8.0	6.3	8.5	7.2	6.1	5.5	7.3
FIVE	9.6	9.6	4.2	6.6	7.0	7.3	6.5	11.5	10.1	7.8	5.9	7.8
SIX	11.4	7.3	5.5	6.9	6.5	6.9	6.3	6.5	6.0	3.8	7.5	6.8
SEVEN	10.9	7.0	6.3	2.9	2.9	2.7	2.4	4.0	4.2	5.8	5.7	5.0
EIGHT	* _____	* _____	* _____	5.3	5.7	6.1	5.0	10.6	11.3	8.4	7.2	8.5
NINE	* _____	* _____	* _____	6.2	4.3	4.8	4.7	5.0	4.0	2.3	1.7	4.7
MEAN	10.1	7.2	5.5	6.1	6.0	6.1	5.6	7.9	7.6	6.0	6.4	6.8

\* Experiment only 7 days duration

FIG. 1 Patterns of bit earning and spending throughout a typical day. Bits shown are the total number of bits earned and spent during each hour by all eight subjects for all five days.

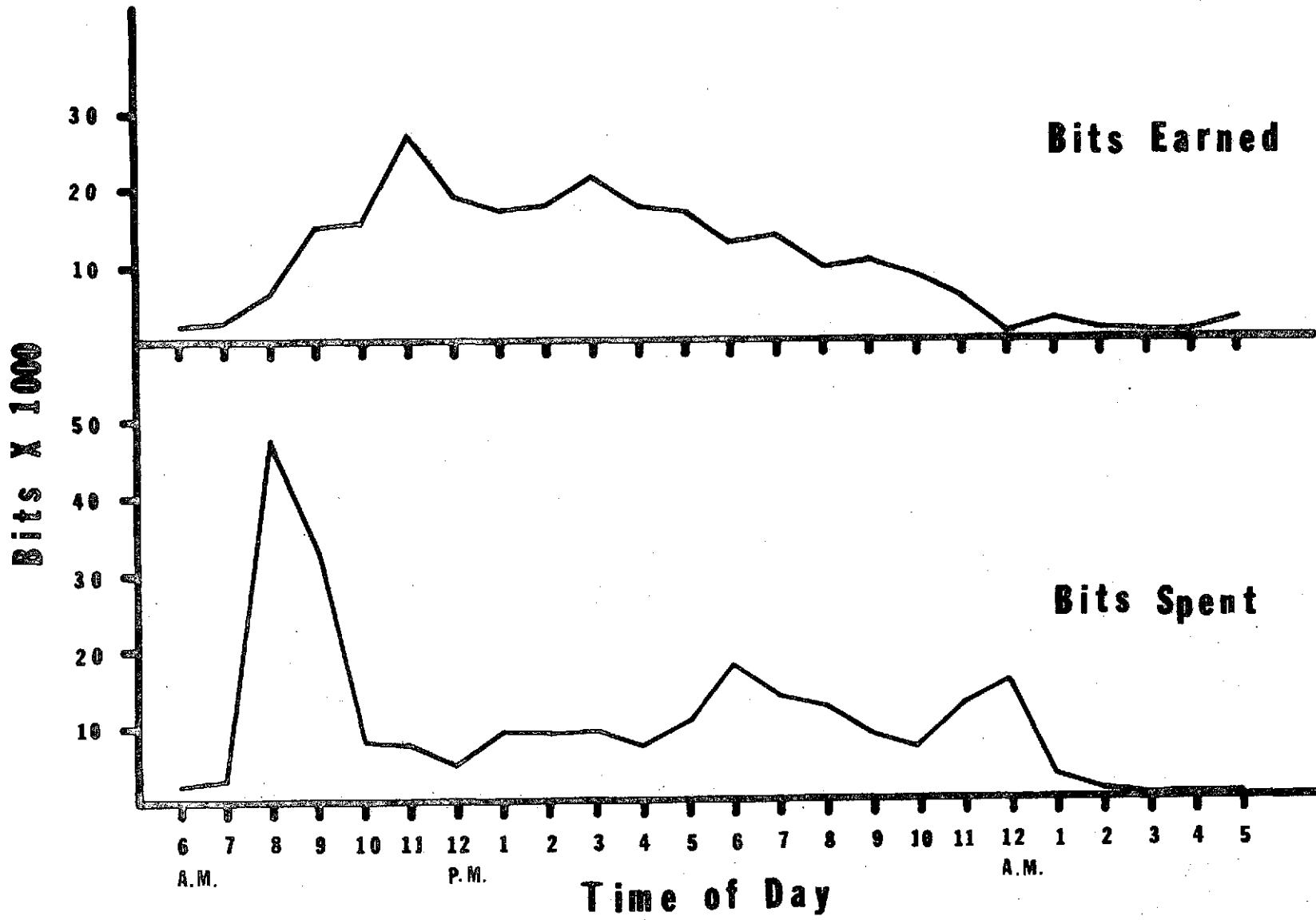


Fig. 2 Total man hours of work on the statistics course as a function of time of day during the group experiments. The figure thus indicates the relative distribution of work among the hours of the day.

TABLE V  
COMPARATIVE MEASURES OF WORK AND PRODUCTIVITY  
FOR EACH SUBJECT

MEASURES	SUBJECTS								MEAN
	A1	B1	A2	B2	A3	B3	A4	B4	
AVERAGE HOURS PER DAY WORKING PROGRAMS	5.26	5.08	4.60	5.01	4.16	6.86	6.30	4.83	5.26
AVERAGE PERCENT OF WAKING HOURS PER DAY WORKING PROGRAMS	32%	30%	29%	33%	25%	41%	35%	32%	32%
EFFICIENCY RATIO (AMOUNT COMPLETED TIME WORKING)	.87	.86	1.22	.98	1.11	.98	1.05	.81	.99
AVERAGE NUMBER OF BITS EARNED PER DAY	5326	6053	5991	6131	4892	7989	7335	4681	6050



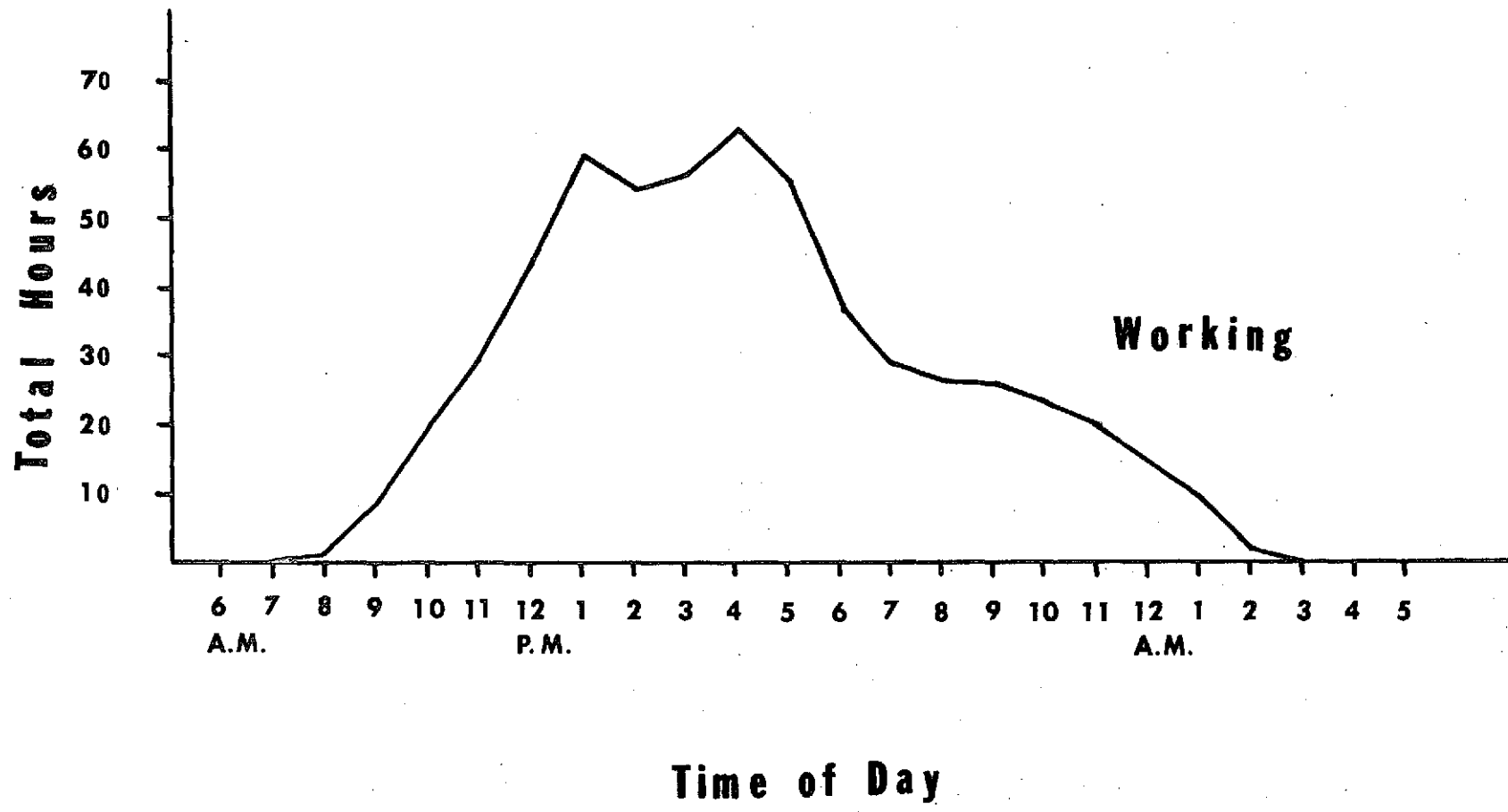


TABLE VI  
 TIME WORKING ON STATISTICS COURSE, AND DEGREE OF  
 ATTAINMENT FOR SUBJECTS IN GROUP EXPERIMENTS

	SUBJECTS										
	G12	G13	G14	G21	G22	G23	G24	G31	G32	G33	G34
% TOTAL TIME WORKING	42	31	24	26	25	26	24	33	32	25	27
% WAKING TIME WORKING	60	46	39	39	35	36	35	51	49	40	38
% OF POSSIBLE MATERIAL COVERED	60	85	67	100	100	100	100	75	75	75	95
COURSE GRADE	C	B	C	A	A	A	A	C	C	C	A
FINAL EXAM GRADE	70	85	80	92	96	96	100	90	90	95	98
AVG. UNIT TEST GRADE	70	90	90	95	98	98	99	83	89	94	98
UNITS REWORKED	3	0	2	1	1	1	1	5	3	4	0
% POSSIBLE EFFECTIVENESS	60	83	75	85	90	90	96	70	70	75	96
% TIME COMMUNICATING ABOUT WORK	7	7	4	13	12	12	13	16	15	9	8

TABLE VII  
PROGRAM USE BY SUBJECTS

	# Units	Units Worked By Each Subject								% Use
		A1	B1	A2	B2	A3	B3	A4	B4	
100	8	8	8	8	3	1	8	8	4	75%
150	12	7	12	12	12	3	0	12	0	60%
200	9	0	0	0	0	3	0	0	9	17%
250	8	0	0	3	0	7	8	8	0	41%
300	13	4	0	0	0	13	1	13	13	42%
350	7	7	0	3	3	0	7	6	0	46%
400	12	0	0	0	0	5	0	0	0	5%
450	10	0	0	0	0	4	10	10	0	30%
500	6	6	6	6	6	2	6	0	6	79%
550	7	0	0	7	7	0	7	0	0	38%

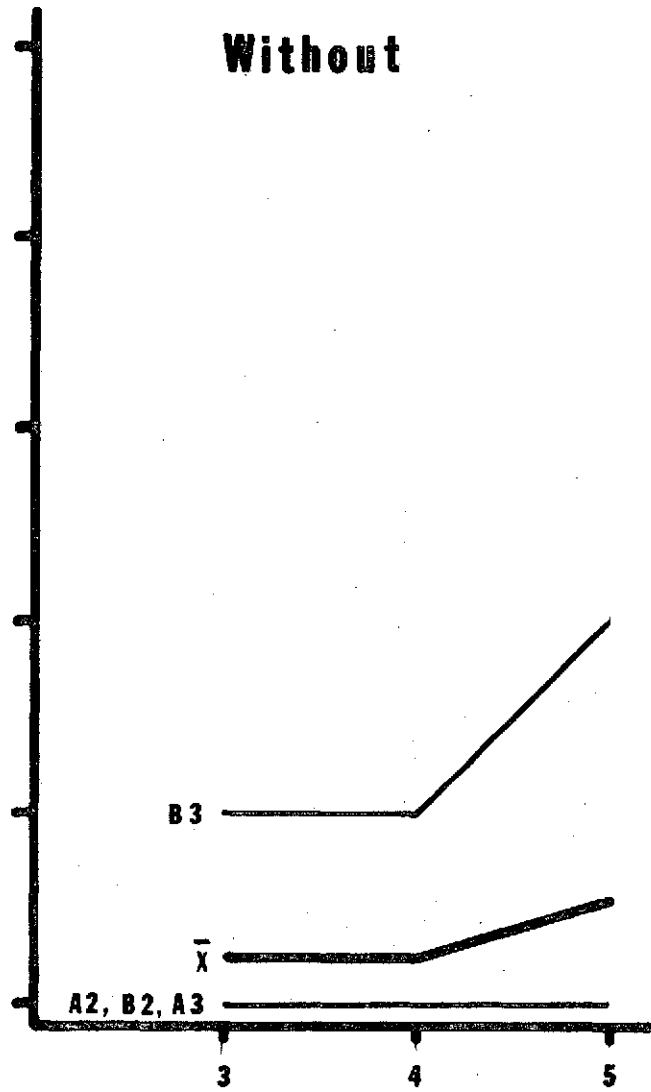
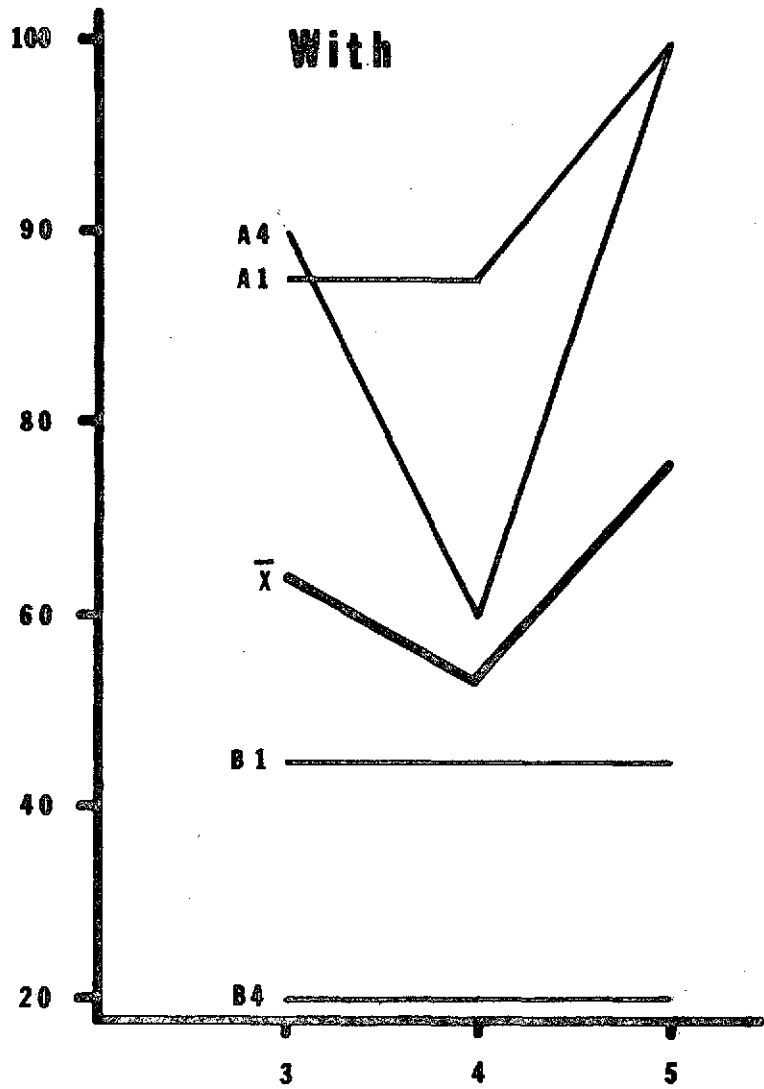
experiment. A comparison of data from these experiments and those of other experiments in this lab suggests that an average of at least five hours per day of significant meaningful work is required for satisfactory enjoyment of this kind of situation.

#### FURNISHINGS AND DECOR

Of the four subjects who spent the first two days of the individual experiment in the condition of minimal furnishings, only one purchased any furniture at all on the remaining three days. On all three of these days he ordered the large chair, and on the fifth day he also bought the drapes. Three of the four who began with furnishings bought some furnishings on all three of the remaining days. Two of these purchased all possible furnishing items on the final day, (Fig. 3). The initial conditions did appear to have a pronounced effect on the subsequent value of furnishing and decor options. There appear to have been additional effects from these conditions. As seen in Table VIII, both sets of subjects spent the same percent of waking hours working, but those without were more efficient, earning a greater number of BITS per day. As seen in Fig. 4 they continued earning more throughout the experiment, maintaining a larger bank balance, even to the point of having more BITS left in their account at the end of the experiment. It appears that the first two days may have established the environment as

FIG. 3 Percent of available furnishings and decor items purchased during the last three days of isolation. The "with" subjects were provided with a complete complement of furnishings and decor items during the first two days of isolation. The "without" subjects were provided a minimal set of furniture and no decor items during the first two days. All were allowed to purchase any available items during the last three days.

Percent of Possible Furnishings Purchased



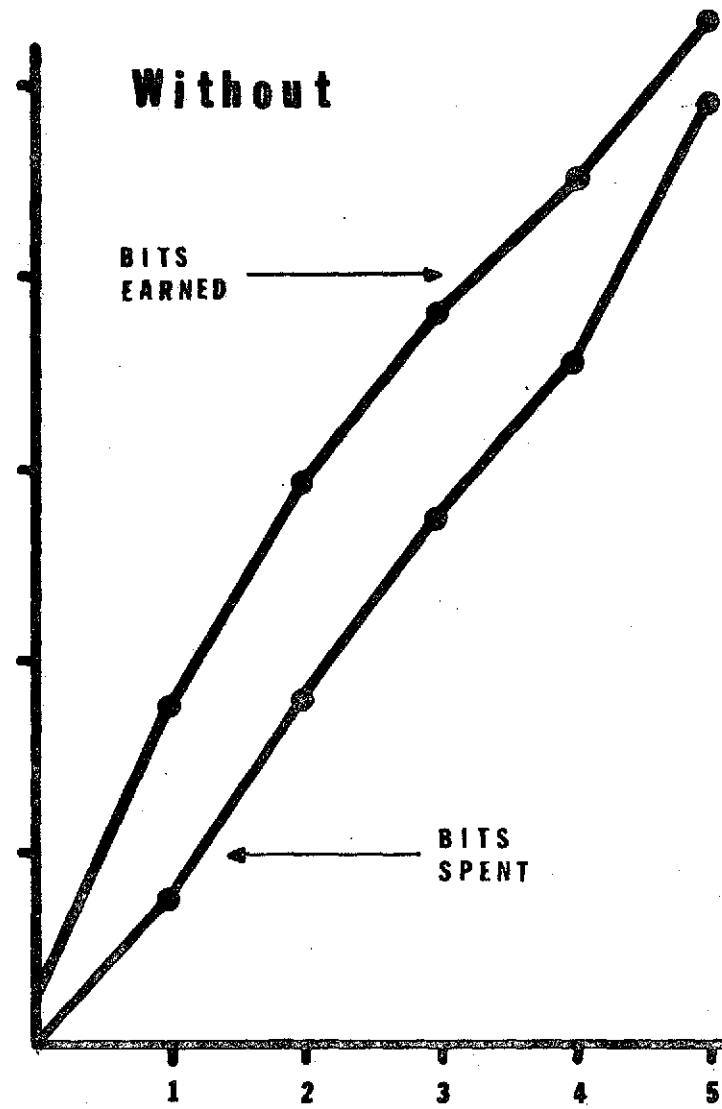
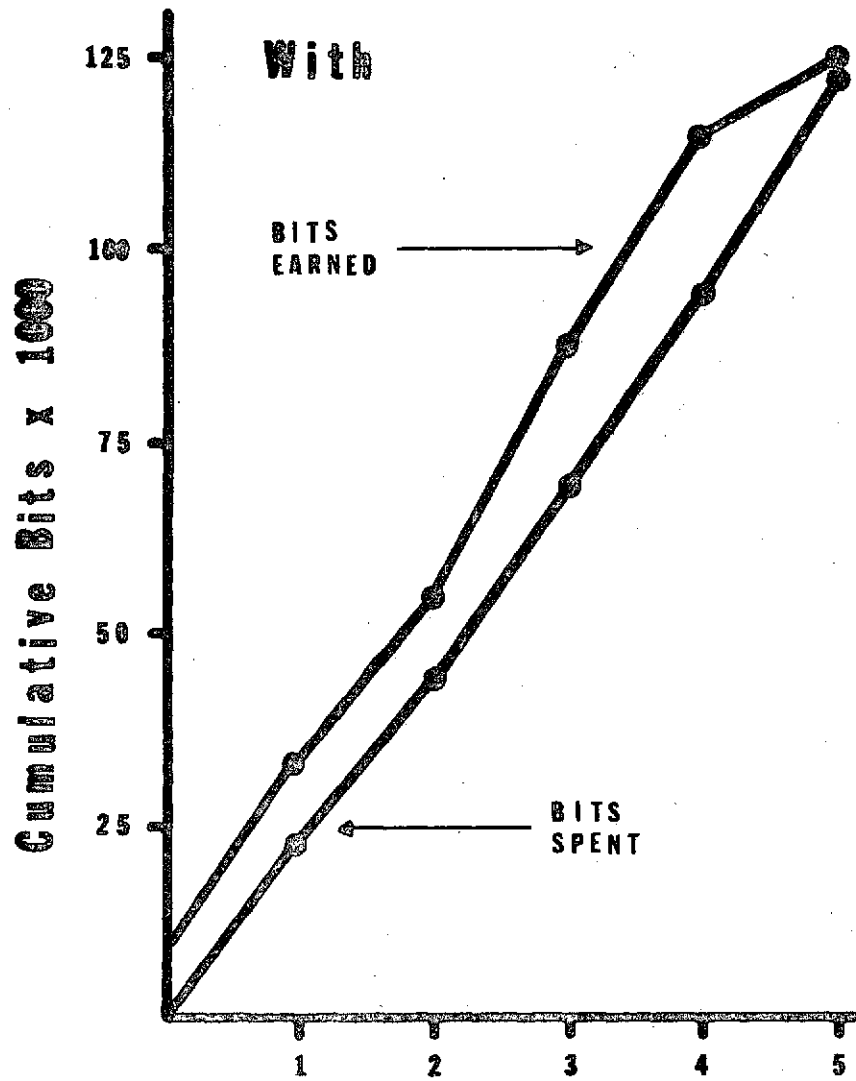
Day of Confinement

TABLE VIII  
 COMPARATIVE MEASURES OF WORK  
 AND PRODUCTIVITY FOR SUBJECTS  
 UNDER DIFFERENT INITIAL ROOM DECOR CONDITIONS

MEASURES	SUBJECTS WITH FURNISHINGS FIRST TWO DAYS	SUBJECTS WITHOUT FURNISHINGS FIRST TWO DAYS
AVERAGE HOURS PER DAY WORKING PRO- GRAMS	5.37	5.16
AVERAGE PERCENT OF WAKING HOURS PER DAY WORKING PROGRAMS	32%	32%
EFFICIENCY RATIO (AMOUNT COMPLETED TIME WORKING)	.90	1.07
AVERAGE NUMBER OF BITS EARNED PER DAY	5844	6251

FIG. 4 Cumulative bits earned and spent by the two furnishings groups. The "with" group consisted of the four subjects who were provided a complete complement of furnishings and decor during the first two days of isolation. The "without" group consisted of the four subjects who were provided minimal furnishings and no decor items during the first two days. Bits were totaled for all four subjects and cumulated for the five successive days of confinement. The initial number of bits earned is from program units worked during the briefing on the day before isolation began.





Day of Confinement

being Spartan, less distracting, more appropriate for work than for real enjoyment. This pattern was also evident in the pattern of allocation BITS spent, as seen in Fig. 5 and Tables IX and X. More BITS were spent by the non-furnishings subjects for sleep and bathroom, and for the more immediate and distracting items such as TV, movies, communication, food, and alcohol, whereas those with furnishings spent more on the "finer" things; work aids, clothes, books, music, and furnishing and decor. The differences between the with and without subjects' evaluations of the experiment, shown in Tables XI and XII, did not follow any consistent pattern. The without people made both more positive and more negative comments during the debriefing, even about the characteristics of the environment, but there was not a trend toward more negative than positive. The general trend of these data seem to indicate that enhanced furnishing and decor may lead to a decrement rather than improvement in performance, may be distracting from work in leading to an increase in deeper leisure. These data do not, however, permit a conclusion about possible effects on thoughtfulness and creativity, which are important in many situations.

#### ACCESSORIES FOR CONVENIENCE IN WORK AND HOUSEKEEPING

In the individual experiments the standard work conditions were extremely meager. Although a considerable amount of writing was required the only free provision was first grade tablet paper and

FIG. 5 Number of bits spent for each of the types of items available during isolation. The "with" group consisted of the four subjects who were provided a complete complement of furnishings and decor items during the first two days of isolation. The "without" group consisted of the four subjects who were provided minimal furnishings and no decor items during the first two days. The number of bits shown is the total for each group during all days of isolation.

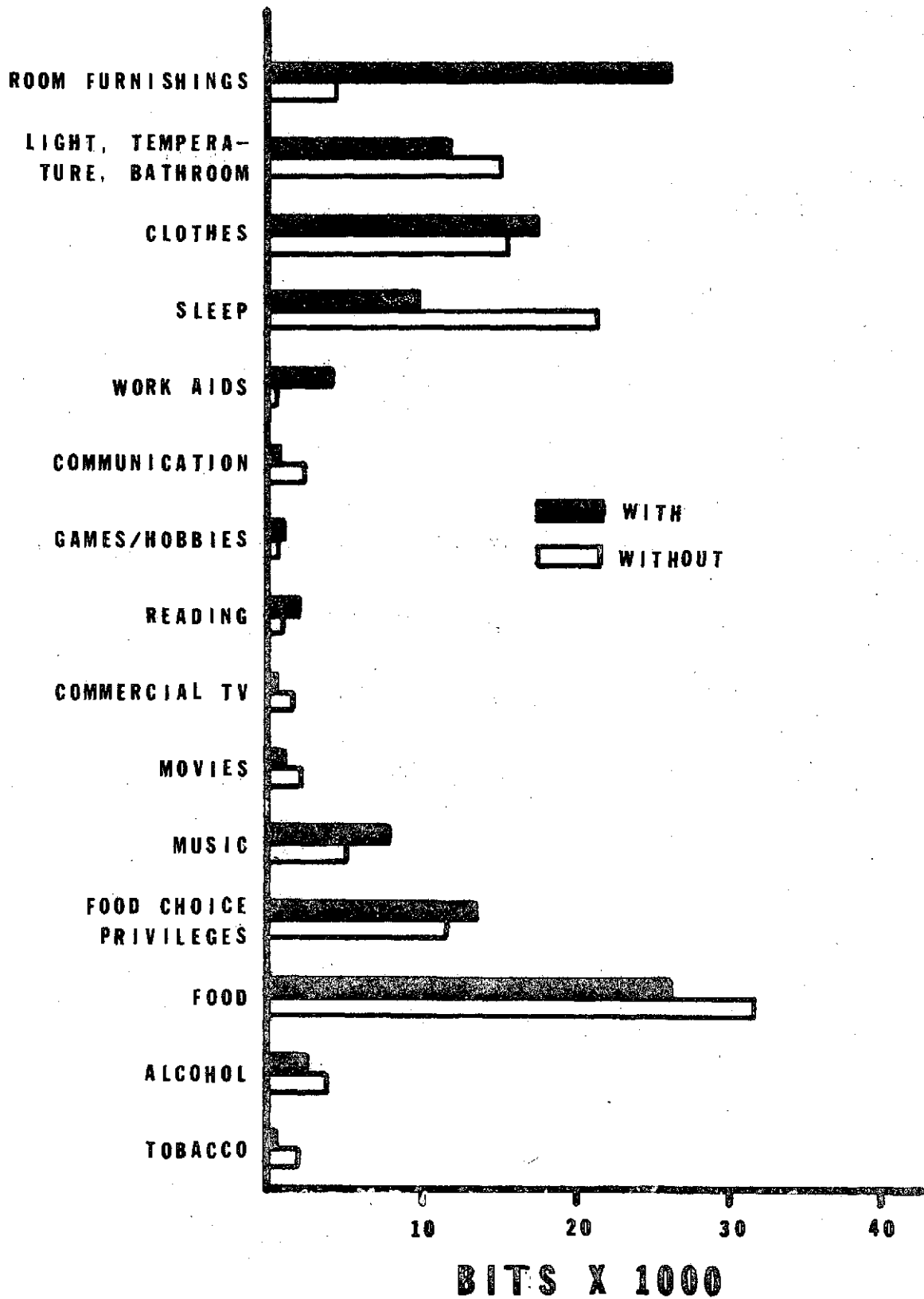


TABLE IX  
 PERCENT OF TOTAL EARNED BITS SPENT FOR VARIOUS TYPES  
 OF ITEMS DURING FIVE DAY ISOLATION PERIOD.

TYPE OF EXPENDITURE	SUBJECTS WITH FURNISHINGS FIRST TWO DAYS	SUBJECTS WITHOUT FURNISHINGS FIRST TWO DAYS	ALL SUBJECTS COMBINED
ROOM FURNISH- INGS	20.86	3.53	12.26
LIGHT, TEMPER- ATURE, BATH- ROOM	9.44	12.90	11.17
CLOTHES	13.91	13.63	13.77
SLEEP MATERIAL	7.89	18.05	12.96
WORK AIDS	3.35	.24	1.80
COMMUNICATION	.52	1.82	1.17
GAMES/HOBBIES	.74	.46	.60
READING MATERIAL	1.59	.82	1.21
COMMERCIAL TV	.29	1.35	.82
MOVIES	.79	1.28	1.04
MUSIC	6.34	4.10	5.22
FOOD CHOICE PRIVILEGES	10.86	7.55	9.21
FOOD	21.02	29.30	25.16
ALCOHOL	1.98	2.94	2.46
TOBACCO	.39	1.75	1.07

TABLE X  
NUMBER OF BITS SPENT FOR CATEGORIES  
OF ITEMS DURING FIVE DAYS

TYPE OF ITEM	SUBJECTS WITH FURNISHINGS FIRST TWO DAYS	SUBJECTS WITHOUT FURNISHINGS FIRST TWO DAYS	ALL SUBJECTS
ROOM FURNISHINGS	25,920	4,320	30,240
LIGHT, TEMPER- ATURE, BATHROOM	11,727	14,980	26,707
CLOTHES	17,280	15,405	32,685
SLEEP	9,780	21,210	30,990
WORK AIDS	4,161	301	4,462
COMMUNICATION	646	2,221	2,826
GAMES/HOBBIES	915	528	1,443
READING	1,973	974	2,947
COMMERCIAL TV	355	1,588	1,943
MOVIES	979	2,057	3,036
MUSIC	7,880	4,995	12,875
FOOD CHOICE PRIVILEGES	13,497	11,452	24,949
FOOD	26,117	31,724	57,841
ALCOHOL	2,465	3,901	6,366
TOBACCO	490	1,961	2,451

TABLE XI  
 ANALYSIS OF DEBRIEFING CONTENT  
 PROPORTION OF OPPORTUNITIES FOR A POSITIVE COMMENT IN  
 WHICH A POSITIVE COMMENT OCCURRED

CATEGORY OF COMMENT	SUBJECTS WITH FURNISHINGS FIRST TWO DAYS	SUBJECTS WITHOUT FURNISHINGS FIRST TWO DAYS
PERSONAL	.45	.45
CONTROL ROOM	.37	.63
CHARACTERISTICS OF ENVIRONMENT	.19	.31
NATURE OF EXPERIMENTAL PROCEDURES	.40	.50
MEAN OF ALL CATEGORIES	.37	.46

TABLE XII  
 ANALYSIS OF DEBRIEFING CONTENT  
 PROPORTION OF OPPORTUNITIES FOR A NEGATIVE COMMENT IN  
 WHICH A NEGATIVE COMMENT OCCURRED

CATEGORY OF COMMENT	SUBJECTS WITH FURNISHINGS FIRST TWO DAYS	SUBJECTS WITHOUT FURNISHINGS FIRST TWO DAYS
PERSONAL	.20	.45
CONTROL ROOM	.21	.21
CHARACTERISTICS OF ENVIRONMENT	.20	.35
NATURE OF EXPERIMENTAL PROCEDURES	.39	.31
MEAN OF ALL CATEGORIES	.25	.44

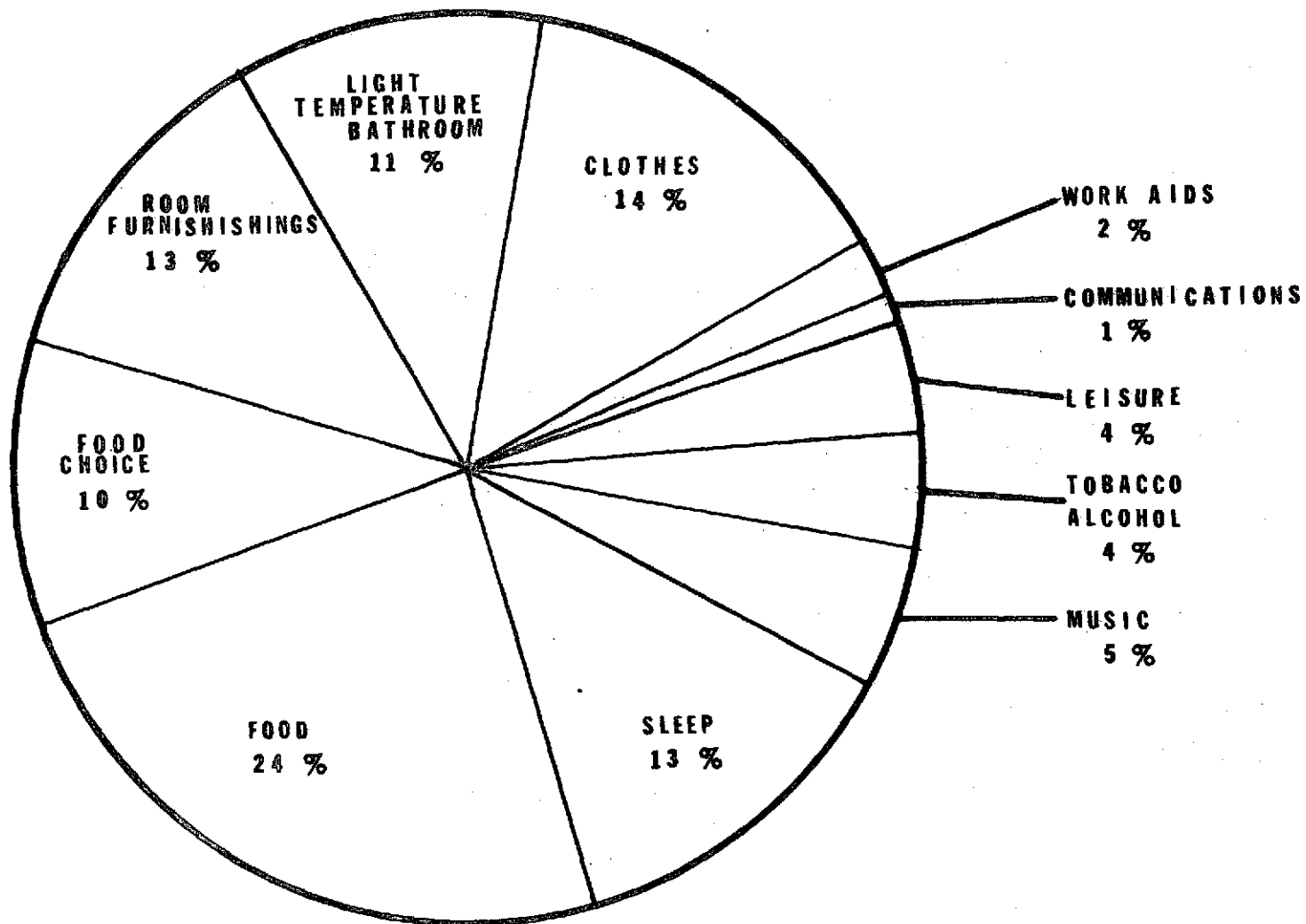


large soft first grade pencils. The only available work space was about 18 inches by 14 inches on the table, or on the floor. A large number and variety of work aids, such as a work table, a variety of paper, pens, and pencils were optionally available. For the four subjects without furnishings at the beginning, a total of approximately 105 hours were spent working; of that total only 5 hours were spent with any work aid at all. This represented 301 total BITS, or .24 percent of the BITS they spent. The four subjects with furnishing spent 4161 BITS, which provided any one work aid for 69 of the total 105 working hours. This expenditure was primarily for the optional work table, and part of the time it was used for dining. Other work aid options used were; pencil sharpener (17 hrs), ballpoint pen (8 hrs), paper (2 hrs), and dictionary (1 hr). These data do not indicate that these items were very important. The data from the Environmental Assessment Inventory Ratings indicate that subjects thought work conditions were very good. Of all the convenience options provided for housekeeping, only one (whisk broom) was ever used, that for one hour by one subject.

#### FOOD AND FOOD CHOICE

As is graphically displayed in Fig. 6, the food related options represented the largest single proportion of the BITS spent, approximately 34%. As seen in Table X this represents 82790 total

FIG. 6 Percent of total earned bits spent for different categories of available items and activities. Percentages are means for all eight subjects during all five days of isolation.

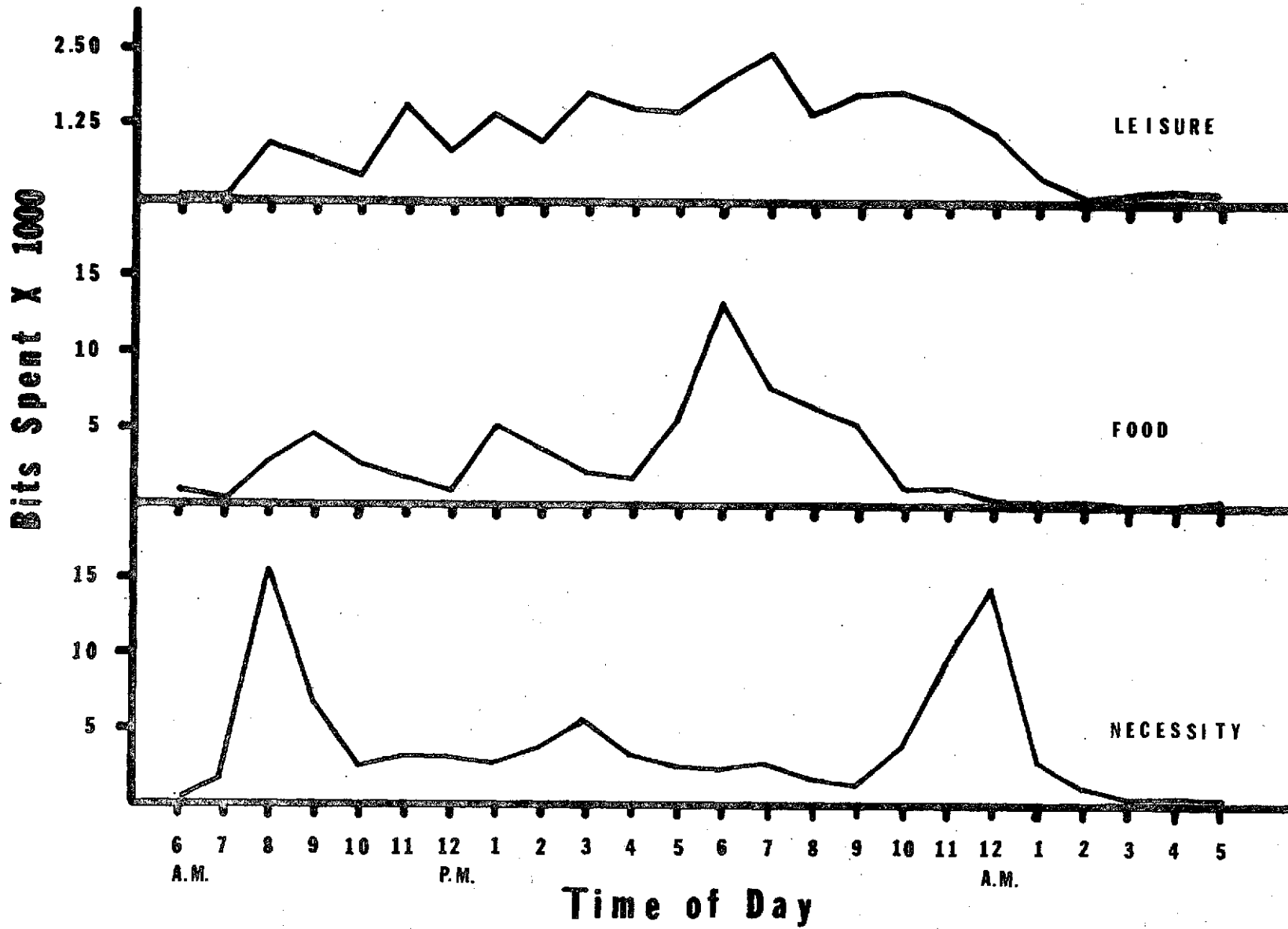


**Relative Allocation of Earned Bits**

BITS. One way of providing perspective for this figure is to contrast it with the minimum cost for ample, edible, nutritional food. That cost would be 28800 BITS. The difference, 53990, represents the investment in opportunity for choice and better than minimal food. This difference required approximately 48 hours of work to purchase. Nearly 23% of the total working time was earning BITS which would ultimately be spent for food qualities above the minimum. Of the 24,949 BITS spent for food choice privileges 6,953 were spent for the category of a preselected menu of natural and restaurant foods and 17,996 were spent for free choice among the same foods (22 times). Thus, 16 hours of work were devoted to providing a free choice of natural foods. Only one subject never purchased this selection. It appears that the quality and choice of food are quite important in work oriented isolation situations.

Fig.7 shows, not unexpectedly, that the majority of food purchases and consumption occurred in the late afternoon and early evening, with the peak period falling immediately after the major work period. This figure indicates smaller peaks at the usual times for breakfast and lunch, with some snacking in between and until about midnight. The distribution of food consumption throughout the day was very similar in the group experiments. In both cases the figures represent the means of all subjects and all days so that

FIG. 7 Pattern of bit spending throughout the typical day. Bits shown are the total number of bits spent during each hour by all eight subjects for all five days. Necessity includes lights, temperature, bathroom and tobacco. Food includes food choice, meals, snacks and alcohol. Leisure includes communications, commercial T.V., movies, games and hobbies, reading materials and music.



the very large amount of variation among individual cases is hidden. It is also important to note that, in the individual experiments, food consumption was temporally paced by the limitations of times certain foods were available from restaurants.

### CLOTHES

In the individual experiment, boxer shorts and tee shirts were provided for wear at no cost. For a charge of one BIT per minute, subjects could wear their choice of their own clothes. As is indicated in Tables IX and X, and Fig. 6, this option was elected quite often. Of the total 960 man hours of confinement, 545, or 57% were in the clothes condition. There were essentially three kinds of subjects with respect to this option, those who never purchased it (2), those who purchased it for the entire time (2), and those who purchased it during waking hours (4). There was no major difference between the with and without furnishing groups, nor has any other relationship been identified.

### CCTV VIEW OF CONTROL ROOM

This provision was available in both the group and individual experiments. It was occasionally used in both experiments, but seldom for a duration more than a few minutes at a time. Except for two pairs of subjects who innovated a remote party with the control room on the last evening of their confinement, the use of

this option was less than 1% of total time per person. Each of the subjects in both experiments used this option at least once. Almost all commented that it did seem important to them during isolation. The common sequence of events included the subjects waving at the camera and saying hello, followed by a wave and smile from the control room personnel, whereupon business as usual was resumed. No difficulties of interaction between subjects and the control room were encountered because of this option.

#### COMMUNICATION

In the individual experiments the two subjects were isolated from each other and from the control room, with the only available communication via the primary telephone system. Interaction with the control room concerning options followed a very limited formal protocol. All free form communication with the control room and all communications with the other subject were standard options. As can be seen in Table IX, such communication was more frequent among the without furnishings group. More than half of the total time of such communication occurred during the two remote parties, during which time each subject paid for communication with the control room and one paid for communication with the other. This represents about 35 hours of the total man hours for which communication was purchased. The remaining twelve hours



were relatively equally divided among the eight subjects and tended to occur more in the later than earlier days. On the average, excluding the parties, subjects spent about 18 minutes per day in communication, with approximately 2/3 of this time talking to the control room. This striking paucity of communications in the individual isolation situation has been seen in all similar experiments run in this laboratory. The subjects seem to have appreciated the lack of intrusion by other people, and certainly found the communication option to be of low value.

In the group experiments, the subjects were in physical proximity with each other most of the time, and free to communicate at will. As may be seen in Table XIII an average of 26% of time was spent in communication among the subjects, with a range among subjects from 19% to 35%. Interestingly, 42% of the communication was about their work, which they had been encouraged to do together. An average of only 4% of the communications were negative in either content or direction. In the situation of physical interaction, then, communication among subjects was far more prevalent. In that situation, however, communication with the control room was of even less value, occurring only .15% of the time.

An informal, but repeated observation in this laboratory, in both the experiments reported here and many others, is that the

TABLE XIII  
PERCENT OF TOTAL TIME SPENT IN VARIOUS ACTIVITIES  
BY SUBJECTS IN GROUP EXPERIMENTS

ACTIVITIES	SUBJECTS												MEAN
	G11	G12	G13	G21	G22	G23	G24	G31	G32	G33	G34		
% SLEEPING	30	35	42	34	29	28	34	35	35	37	30	34	
% WORKING	42	31	24	26	25	26	24	33	32	25	27	29	
% WAKING TIME WORKING	60	46	39	39	35	36	35	51	49	40	38	43	
% MUSIC	5.1	7.2	3.9	7.3	7.4	9.2	7.6	5.6	6.6	6.9	7.2	6.7	
% TV	3.4	6.9	16.0	7.6	7.7	9.7	9.0	1.7	2.1	4.3	3.7	6.6	
% READING	.47	.23	.89	1.5	2.4	5.7	6.7	1.3	1.5	2.6	6.6	2.7	
% COMMUNICATING	19	19	13	35	33	29	29	30	29	24	21	26	
% COMMUNICATING ABOUT WORK	6.7	6.8	4.2	13.4	12.4	11.9	12.9	15.5	14.9	8.5	7.9	11	
TOTAL HOURS AWAKE	*1176	*1097	*983	1431	1538	1547	1428	1404	1396	1368	1516	1353.09	
TOTAL HOURS WORK	*709	*505	*385	552	541	553	505	709	685	541	577	569.27	

\*Experiment only 7 days duration

nature and content of the communication between the control room and subjects can be highly critical. It can veer very easily in a positive or negative direction, and once that direction occurs it tends strongly to continue. It is very difficult to maintain a "neutral", "objective", or "professionally sterile" interaction, very subtle interactions easily tilt the balance one way or the other, and once the balance is shifted a great deal of careful effort is required very soon to prevent a long term, serious continuation of this shift. It is clearly apparent in this laboratory that this phenomenon should be thoroughly investigated in the near future, particularly since its occurrence has been obvious in several real man in isolation situations.

#### LIVING PROVISIONS AND SPACE

In the individual experiments most provisions for general living were included as part of the option set of the closed economy. In some cases their inclusion was primarily for making the system complete, and the data from these are not particularly revealing. All subjects did purchase temperature control, as opposed to the free 55°F condition, throughout the entire experiment. All also purchased lights during almost all of their waking hours. Subjects all bought mattresses to sleep on. Pillows were purchased for approximately 28% of sleeping hours and blankets for 20%. Subjects

purchased an average of 59 minutes per day in the bathroom, 32 of those minutes included the sink, 32 included hygiene materials, and 24 minutes included the shower. The bathroom was the only area receiving a "poor" rating on the Environmental Assessment Inventory; that rating was due to the odor of the chemical toilet. Subjects did not make serious complaints about the limited amount of space available. The general Environmental Assessment Inventory rating for amount of space available was 2.5, which represents a rating of "fair." These and other ratings are shown in Table XIV.

In the group experiments the space was larger and more varied. Table XV shows the percent of time the various areas were used for waking activities. Sleep time is not shown as "use" in this table; sleeping occurred almost universally in the staterooms except for one subject who slept in the workroom. The majority of work occurred in the workroom, most other activities occurred in the staterooms. This clear division of use was probably due to the presence of the large permanent table in only the workroom, leaving much more open space in the staterooms. Eating also occurred almost universally at the workroom table.

#### LEISURE

As indicated by Fig. 8, spending for leisure options occurred

TABLE XV  
 PERCENT OF TOTAL TIME SPENT AWAKE  
 IN VARIOUS LOCATIONS  
 BY SUBJECTS IN GROUP EXPERIMENTS

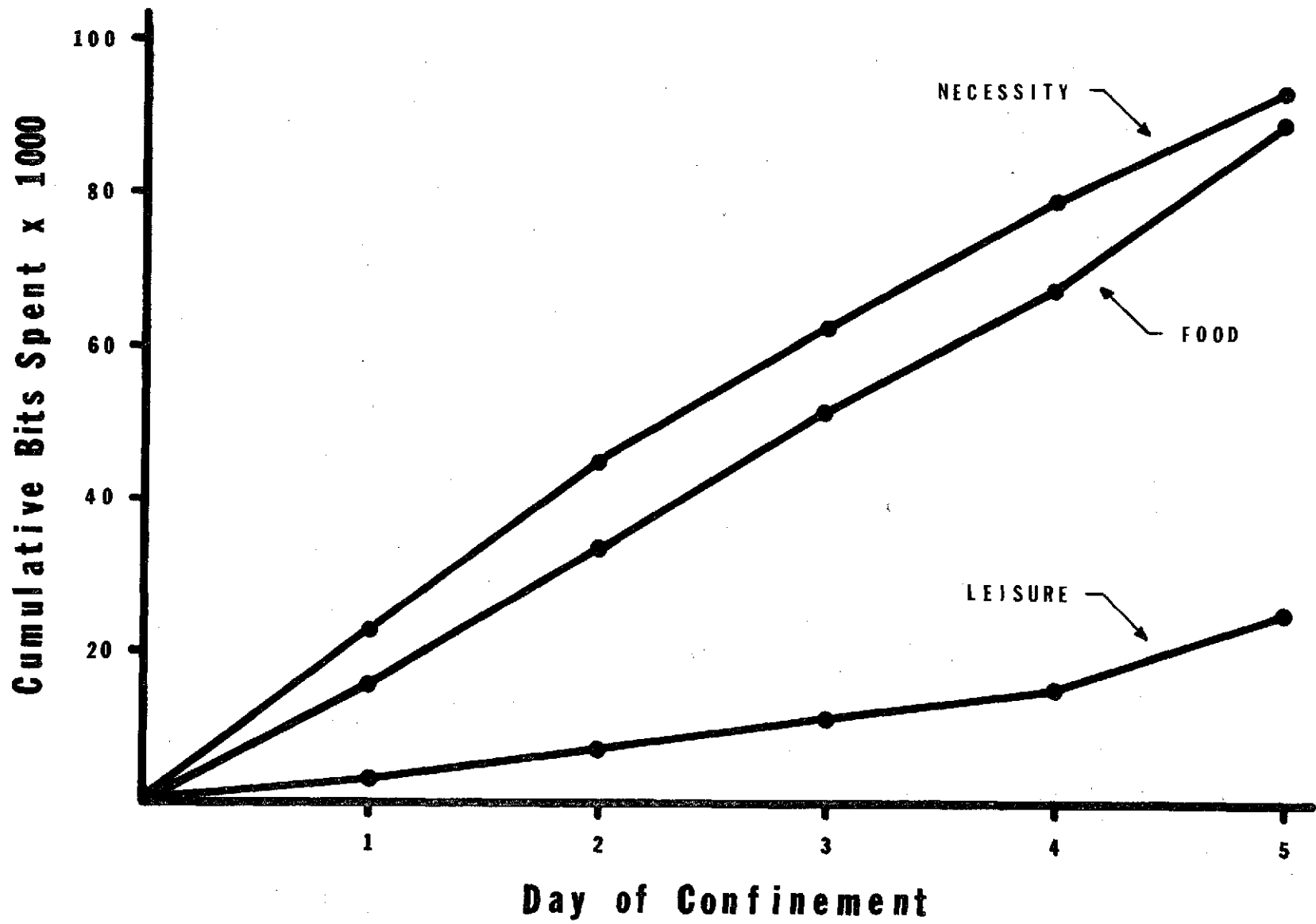
LOCATIONS	SUBJECTS											MEAN
	G11	G12	G13	G21	G22	G23	G24	G31	G32	G33	G34	
WORK ROOM	46	39	27	39	36	39	37	36	34	24	34	35.5
STATEROOMS	12	15	41	10	17	25	19	17	21	26	17	20
HALL/GALLEY	5.6	6.8	4.6	11.6	13.0	4.8	7.2	7.0	5.7	6.3	12.2	7.7
HEAD	5.5	4.2	2.6	3.7	4.5	3.2	2.1	3.9	3.6	5.0	5.6	4.0

ENVIRONMENTAL ASSESSMENT INVENTORY RATINGS  
AVERAGED ACROSS ALL EIGHT SUBJECTS

CHARACTERISTICS OF AREA USED	Area Used for Various Activities							
	Sleep	Food	Exercise	Recre- ation	Work Tasks	Waste Elimin- ation	Hygiene	General
Enough Room	2.75	2.62	1.87	2.87	2.87	2.37	2.50	2.50
Lighting Satisfactory	3.50	3.75	3.62	3.50	3.12	3.00	2.87	3.25
Area of Activity Satisfactory	3.25	3.25	2.62	3.25	3.25	3.12	3.25	---
Physical Layout Satisfactory	3.00	2.87	2.50	3.12	3.57	2.75	2.62	3.00
Noise Level	2.87	3.62	3.50	3.00	3.00	3.25	3.37	3.12
Lack of Odor	3.62	3.75	3.62	3.62	3.62	1.62	2.25	3.00
Temperature Satisfactory	3.00	3.25	3.50	3.12	3.25	3.26	3.25	3.12
Humidity Satisfactory	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.37
Enough Time Allowed	3.12	3.50	3.50	3.37	3.25	3.12	3.25	---
Times of the Day Available for Activity Good	3.57	3.28	2.28	3.42	3.71	3.25	3.50	---
Good Selection And Variety	---	3.37	2.25	2.62	2.87	---	---	---
Habitat Affect on Activity in General	3.50	3.12	2.37	3.00	3.37	2.85	2.85	---

INTERPRETATION OF SCALE: 1 = Poor; 2 = Fair; 3 = Very Good; 4 = Excellent.

FIG. 8 Cumulative number of bits spent for various types of items during successive days of isolation. Bits were totaled for all eight subjects for each of the types of items, and cumulated for successive days. Necessity includes lights, temperature, bathroom and tobacco. Food includes food choice, meals, snacks and alcohol. Leisure includes communications, commercial T.V., movies, games and hobbies, reading materials and music.





at a fairly regular rate until the last day, when the rate of leisure and food spending increased and the rate of earning decreased. This same trend is apparent in the total rate of spending, shown in Fig. 9. As the latter figure shows, the size of the bank accounts (the difference between the curves) was maintained relatively constant during days 2, 3, and 4, but was reduced on day 5. The relative expenditures for various types of leisure options are depicted in Fig. 10, and percentages for individuals are compiled in Table XVI.

The leisure option of highest value was music, in both the individual and group experiments. In the individual experiments 23% of waking time was spent with music; 9% in the group experiments. Data from other experiments in this lab also indicate the high value of music in both group and individual experiments, and suggest that the relatively low 9% for the present group studies may be due to the emphasis on group work and the very inconvenient music facilities for the workroom. Subjects in both experiments predominantly chose music selections they were already familiar with. They rarely chose new selections by favored artists or composers.

A relatively good selection of movies was available on videotape for presentation via the TV sets in both experiments. On the average, this was the second most valuable option, being used 7.7% of waking hours in the individual experiments and 7.5% in the group

FIG. 9 Cumulative bits earned and spent during successive days of isolation. The bits were totaled for all eight subjects and cumulated for the five successive days of isolation. The initial number of bits earned is from program units worked during the briefing on the day before isolation began.

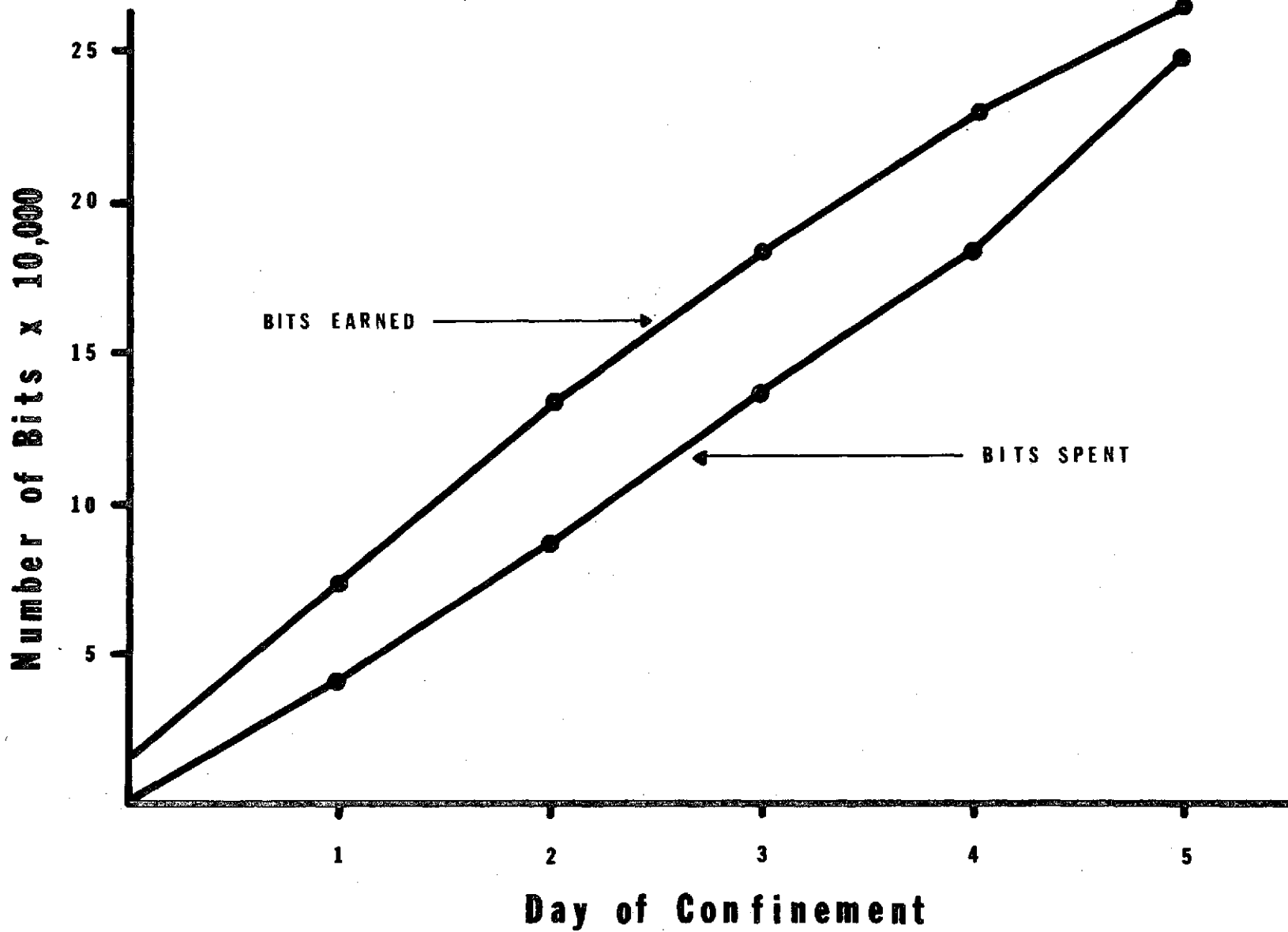
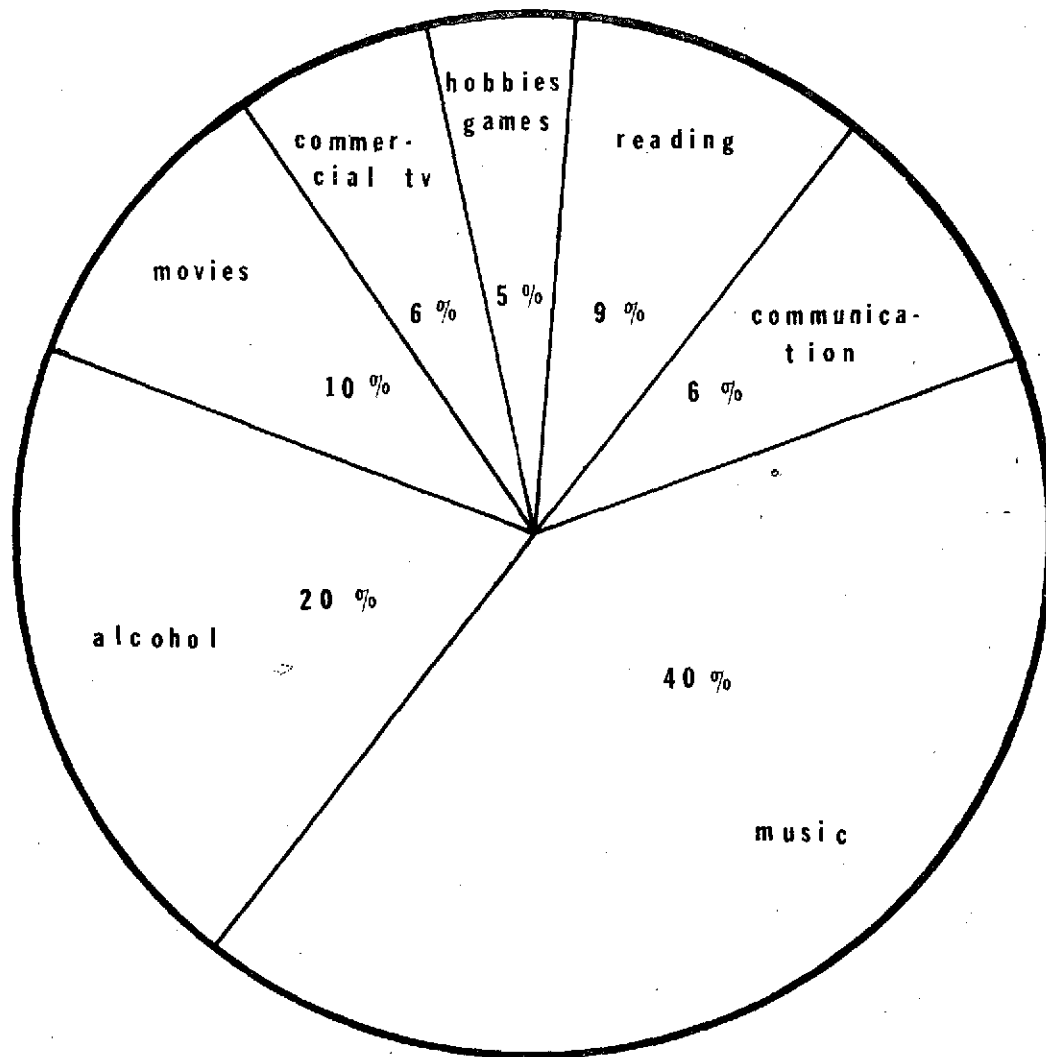


FIG. 10 Percent of leisure bits spent for various types of leisure activities. Percentages are means for all eight subjects during all five days of isolation.



**Relative Allocation of Bits Spent for Leisure**

TABLE XVI  
 PERCENTAGE OF EARNED BITS SPENT BY EACH SUBJECT  
 FOR CATEGORIES OF ITEMS

TYPE OF ITEM	A1	B1	A2	B2	A3	B3	A4	B4
ROOM FURNISHINGS	36.79	10.07	0.00	0.00	0.00	13.19	31.74	0.00
LIGHT, TEMPERATURE, BATHROOM	11.59	12.64	12.04	16.78	11.23	11.55	5.33	8.95
CLOTHES	0.00	22.37	15.89	13.72	24.91	.00	14.11	18.98
SLEEP	7.97	5.59	27.50	12.42	17.63	14.66	4.01	16.37
WORK AIDS	1.23	7.83	.40	.00	.00	.55	3.42	.00
COMMUNICATION	1.26	.74	1.14	2.03	.04	4.08	.06	.06
GAMES/TOYS	1.69	1.26	.31	.33	1.21	.00	.00	.06
READING	1.04	.56	2.62	.05	.17	.43	1.33	3.92
COMMERCIAL TV	1.21	.00	2.86	.67	1.16	.72	.00	.00
MOVIES	.67	1.02	.14	.21	2.73	2.05	.82	.59
MUSIC	3.99	6.87	1.97	2.55	3.43	8.43	6.05	8.84

TABLE XVI (CONTINUED)  
 PERCENTAGE OF EARNED BITS SPENT BY EACH SUBJECT  
 FOR CATEGORIES OF ITEMS

TYPE OF ITEM	A1	B1	A2	B2	A3	B3	A4	B4
FOOD CHOICE PRIVILEGES	9.75	12.71	4.16	3.08	12.95	10.00	10.93	9.71
FOOD	20.34	17.82	24.88	40.79	19.85	31.69	17.88	30.52
ALCOHOL	.76	.53	2.37	2.03	4.69	2.65	4.18	2.00
TOBACCO	1.67	.00	3.63	3.35	.00	.00	.00	0.00

experiments. As seen in Table XVII some individuals spent more time with reading than movies, but this was true of only one individual in the group experiments. The most used movies were "Ballad of Cable Hogue" and "Fantastic Football Funnies."

Reading was the third most valuable leisure option overall. In the individual experiments it equalled movies, occupying 7.7% of waking hours, but considerably less (4%) in the group cases. It appeared that reading required more pronounced withdrawal from the group, a factor not present in individual isolation. Table XVIII indicates that reading was more prevalent among subjects who spent the first two days in an enriched environment. The majority of the material read was relatively light in nature. The two subjects who read most read novels of the last decade and science fiction. Others read more magazines and cartoon type books such as "Peanuts." No real classic or work of nonfiction was ever read. A common thread among the reading selected appears to be its immediate entertainment or distraction qualities.

Commercial TV was watched 5% of waking hours by individual experiment members, and 1.5% of waking hours by group subjects. Less than 20% of that time was news programs, the rest was highly varied.

The least valuable leisure option was games, hobbies, and



TABLE XVII  
 PERCENT OF TIME AWAKE DURING WHICH  
 CERTAIN ITEMS WERE BEING USED

ITEMS	SUBJECTS							
	A1	B1	A2	B2	A3	B3	A4	B4
WORK AIDS	7.3	49.2	2.5	0.0	0.0	3.6	23.8	0.0
GAMES/TOYS	10.0	7.9	2.0	2.0	7.0	0.0	0.0	.3
READING	6.2	3.5	16.4	.3	1.0	2.8	9.2	22.0
COMMERCIAL TV .	7.2	0.0	17.9	3.9	6.7	4.7	0.0	0.0
MOVIES	4.0	6.4	.9	12.3	15.8	13.5	5.7	3.3
MUSIC	15.8	28.8	9.5	10.2	16.1	37.0	31.6	37.1

TABLE XVIII  
 PERCENT OF TIME AWAKE DURING WHICH  
 CERTAIN ITEMS WERE BEING USED

ITEMS	SUBJECTS WITH FURNISHINGS DURING FIRST TWO DAYS	SUBJECTS WITHOUT FURNISHINGS DURING FIRST TWO DAYS	ALL SUBJECTS
WORK AIDS	20.1	1.6	10.8
GAMES/TOYS	4.7	2.8	3.8
READING	10.2	5.1	7.7
COMMERCIAL TV	1.8	8.3	5.0
MOVIES	4.9	10.7	7.7
MUSIC	28.3	18.1	23.3

crafts, including the subjects' own musical instruments. These instruments account for the majority of the 3.8% of waking hours shown for games/toys in Tables XVI and XVIII. They (guitars) were used by subjects A1, B1, and A3. Also occasionally used were simple finger occupiers; marbles, balls, rubber bands, sticks, etc. In the group experiments the use of these options occurred less than 1% of waking time, and was again limited mostly to simple, unstructured items. No structured game was used by these subjects. Most subjects have been observed to spend some time doing minor creative things with whatever they find loose, but seldom was one observed with a structured game or activity.

#### DEBRIEFING

At the end of each individual experiment the subjects each participated in a structured debriefing. The questions asked form four general categories which are listed in Table XIX. Content analysis of the debriefings produced a separation of the responses to these questions or prompts, into three categories, positive, neutral, and negative. Examples of such responses are also shown in Table XIX. If each question or prompt is regarded as an opportunity for a positive or negative response, it is possible to examine the proportion of opportunities in which such responses occurred. This is the source of the data of Tables XX and XXI. A comparison of these tables shows some tendency for subjects to respond in a

TABLE XIX  
 EXAMPLES OF CONTENT OF  
 DEBRIEFING COMMENT CATEGORIES.

CATEGORY OF COMMENTS	POSITIVE	NEGATIVE
PERSONAL	"Enjoyed the experiment" "I slept well"	"Glad experiment is over" "Disliked being watched"
CONTROL ROOM	"Very responsive" "Efficient"	"Occasionally unresponsive" "Briefing and program information insufficient"
CHARACTERISTICS OF ENVIRONMENT	"Environment comfortable, "Furnishings enjoyable"	"Limited esthetic value" "Not enough room"
NATURE OF EXPERIMENTAL PROCEDURES	"Option prices fair" "Protocol functional"	"Inadequate selection of general recreational materials" "Option prices too high"

TABLE XX  
ANALYSIS OF DEBRIEFING CONTENT

PROPORTION OF OPPORTUNITIES FOR A POSITIVE COMMENT IN  
WHICH A POSITIVE COMMENT OCCURRED

CATEGORY OF COMMENT	SUBJECTS								N
	A1	B1	A2	B2	A3	B3	A4	B4	
PERSONAL	.40	.20	.20	.60	.20	.60	.60	.60	5
CONTROL ROOM	.50	.50	.50	1.00	0.00	1.00	0.00	.50	2
CHARACTERISTICS OF ENVIRONMENT	.25	.25	.25	.25	0.00	.75	0.00	.25	4
NATURE OF EXPERIMENTAL PROCEDURES	.40	.50	.60	.40	.30	.70	.20	.50	10
MEAN OF ALL CATEGORIES	.46	.36	.39	.56	.13	.76	.20	.46	

TABLE XXI  
ANALYSIS OF DEBRIEFING CONTENT

PROPORTION OF OPPORTUNITIES FOR A NEGATIVE COMMENT IN  
WHICH A NEGATIVE COMMENT OCCURRED

CATEGORY OF COMMENT	SUBJECTS								N
	A1	B1	A2	B2	A3	B3	A4	B4	
PERSONAL	0.00	.60	.40	.20	1.00	.20	0.00	.20	5
CONTROL ROOM	0.00	.50	.33	0.00	.33	.17	.17	.17	6
CHARACTERISTICS OF ENVIRONMENT	0.00	.20	.20	.20	1.00	0.00	.40	.20	5
NATURE OF EXPERIMENTAL PROCEDURES	.33	.44	.44	.33	.33	.22	.56	.22	9
MEAN OF ALL CATEGORIES	.08	.44	.34	.18	.67	.15	.28	.20	

consistent pattern; some were rather consistently positive, others consistently negative, and some balanced between. This pattern of responding in turn provides an important perspective for the interpretation of individual unique comments since a negative comment about some item by a person with a generally positive pattern probably does not mean the same thing if made by an individual with a generally negative pattern.

After each group experiment each subject was individually debriefed using an unstructured, nondirective technique. This technique was used to minimize the likelihood that the responses were cued in a positive or negative direction by specific questions, and to permit somewhat more meaningful analysis of the time spent talking about various items. Some of the common topics that were discussed are shown in Table XXII. There was, on the average, more time spent in positive than negative comment and again there were differences of general pattern among individuals. Qualitatively, the unstructured debriefings appeared to more accurately reflect the general reactions of the individuals as observed during the experiments.

#### MOOD AND STATE

Each subject in the individual experiments completed the Mood Adjective Checklist (shown in Appendix A) once each day for five days before and after the experiment, and twice each day during the experiment. During the experiment the checklist was administered

TABLE XXII  
 PROPORTION OF TIME TALKING ABOUT VARIOUS ITEMS  
 DURING GROUP EXPERIMENT DEBRIEFINGS

CATEGORIES	SUBJECTS											
	G11	G12	G13	G21	G22	G23	G24	G31	G32	G33	G34	MEAN
TOTAL SECONDS TALKING	1957	1340	905	795	245	325	600	738	957	716	875	859
% OF TOTAL TIME TALKING POSITIVE	34	38	24	49	54	33	63	39	56	38	73	46
% OF TOTAL TIME TALKING NEGATIVE	53	32	46	10	15	1	17	27	39	38	39	29
% ABOUT WORK	22	5	11	9	5	9	13	6	23	9	6	11
% ABOUT WORK POSITIVE	33	65	5	100	80	93	81	42	8	54	100	60
% ABOUT OTHER SUBJECTS	20	6	2	7	3	6	10	16	7	6	13	9
% ABOUT SUBJECTS POSITIVE	64	79	100	100	100	100	83	96	100	0	15	76
% ABOUT CONFINEMENT	1	7	22	18	6	9	10	7	6	9	8	9
% ABOUT CONFINEMENT POSITIVE	100	96	51	100	100	100	100	100	53	90	46	85
% ABOUT BEING OBSERVED	0	1	9	0	3	0	2	2	6	4	8	3



approximately 5 and 11 hours after the beginning of the waking day. The scores from the MACL have been translated to a proportion of possible score, ranging from 0 to 1, where 1 represents the greatest possible amount of that characteristic. As seen in Fig. 11, there were some slight differences between the average scores before, during, and after. There was some elevation of aggression, skepticism, and concentration during the experiment, and an elevation of depression afterwards. Trends during the experiment can be seen more clearly in Fig. 12. Aggression and anxiety decreased slightly, while nonchalance, elation, social affection, and egotism showed some increase. In general, as shown in Fig. 13, positive characteristics tended to be more elevated than negative characteristics. Seen in the same figure and in Table XXIII the negative factors were somewhat more elevated for those subjects who began without furnishings.

Overall, there was a relatively high variability among scores on individual MACL forms for each subject. Informal observation during the experiments suggested that the score on a single MACL was very strongly influenced by the events within the hour or so immediately preceding its completion, particularly when it was temporally close to a strong event such as eating or a difficult work unit. This suggests that accurate interpretation of MACL data will require that it be administered at carefully selected times.

FIG. 11 Extent of elevation of each of the eleven factors of the Mood Adjective Checklist before during and after isolation. All scores are the average of the last four subjects run. The pre and post scores are the average of one test on each of the four days immediately before or after isolation. Scores during the lab are derived from the average of the two tests given each day. The scale of possible scores ranges from 0.0 to 1.0, with 1.0 representing the maximum elevation of a factor.

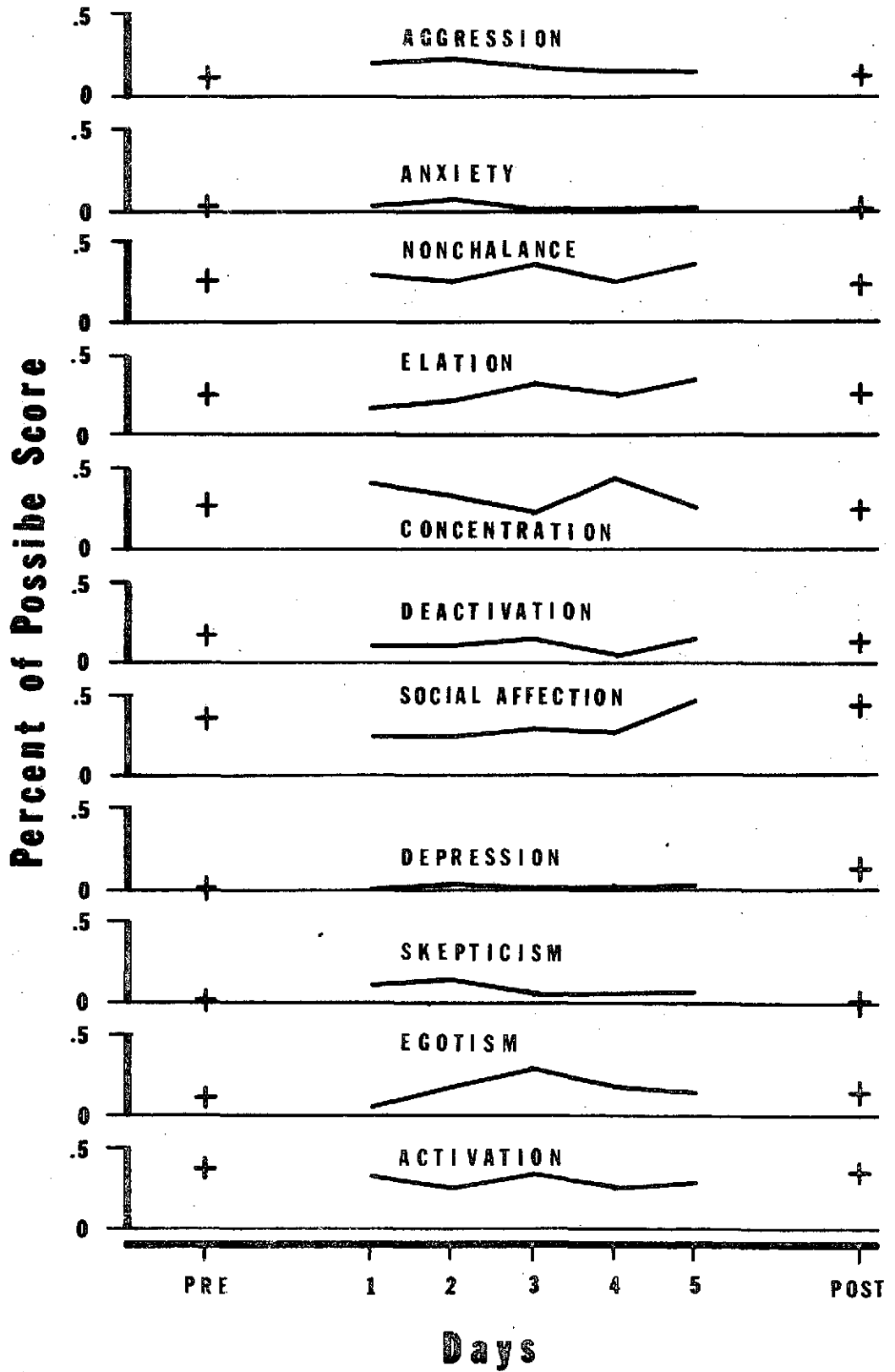


FIG. 12 Extent of elevation of each of the eleven factors of the Mood Adjective Checklist during successive days of isolation. Scores shown are the means of all eight subjects. The scale of possible scores is 0.0 to 1.0 with 1.0 representing maximum elevation of a factor. Tests were given twice daily, with the two tests averaged to provide the daily mean score.

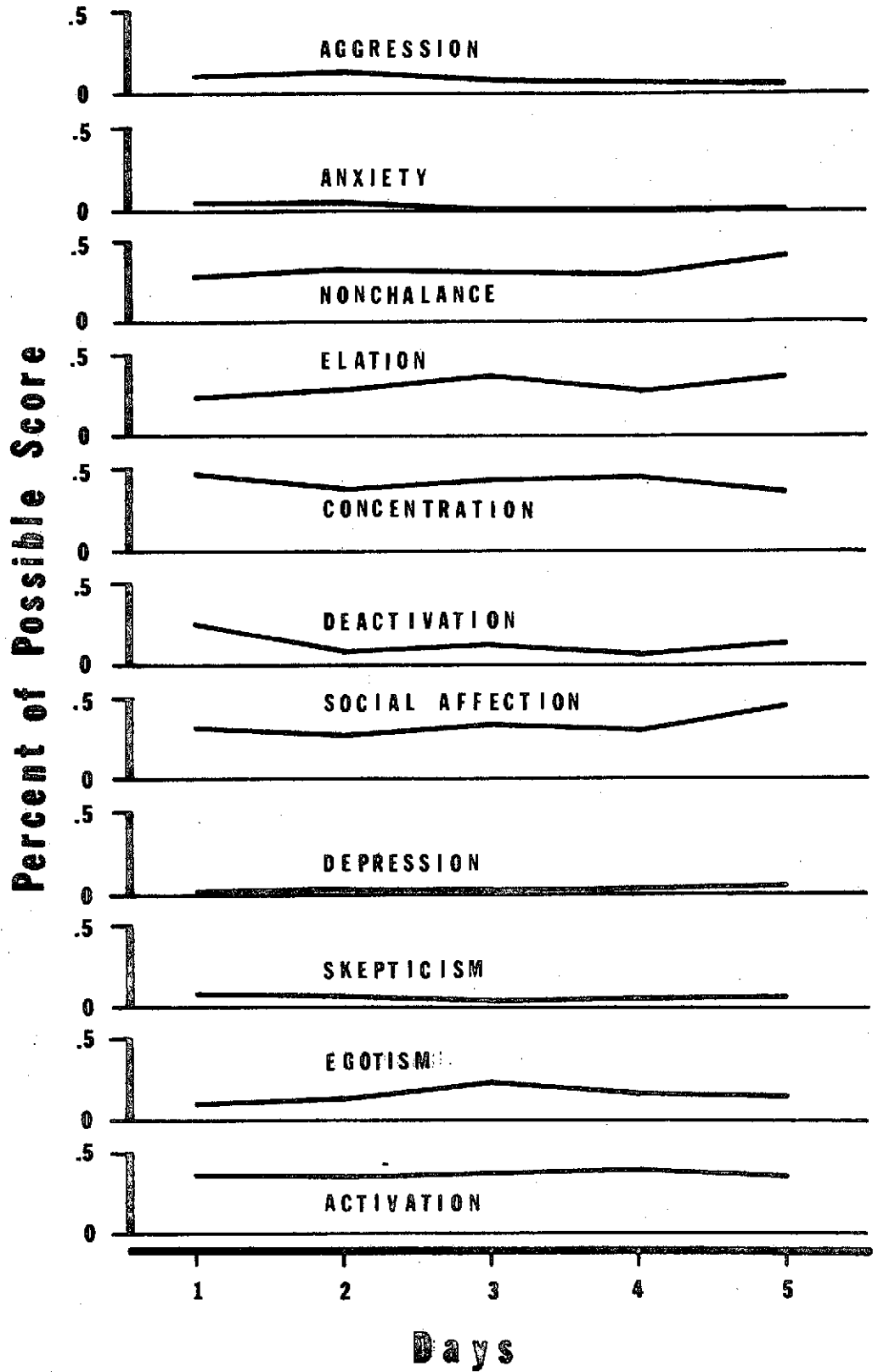
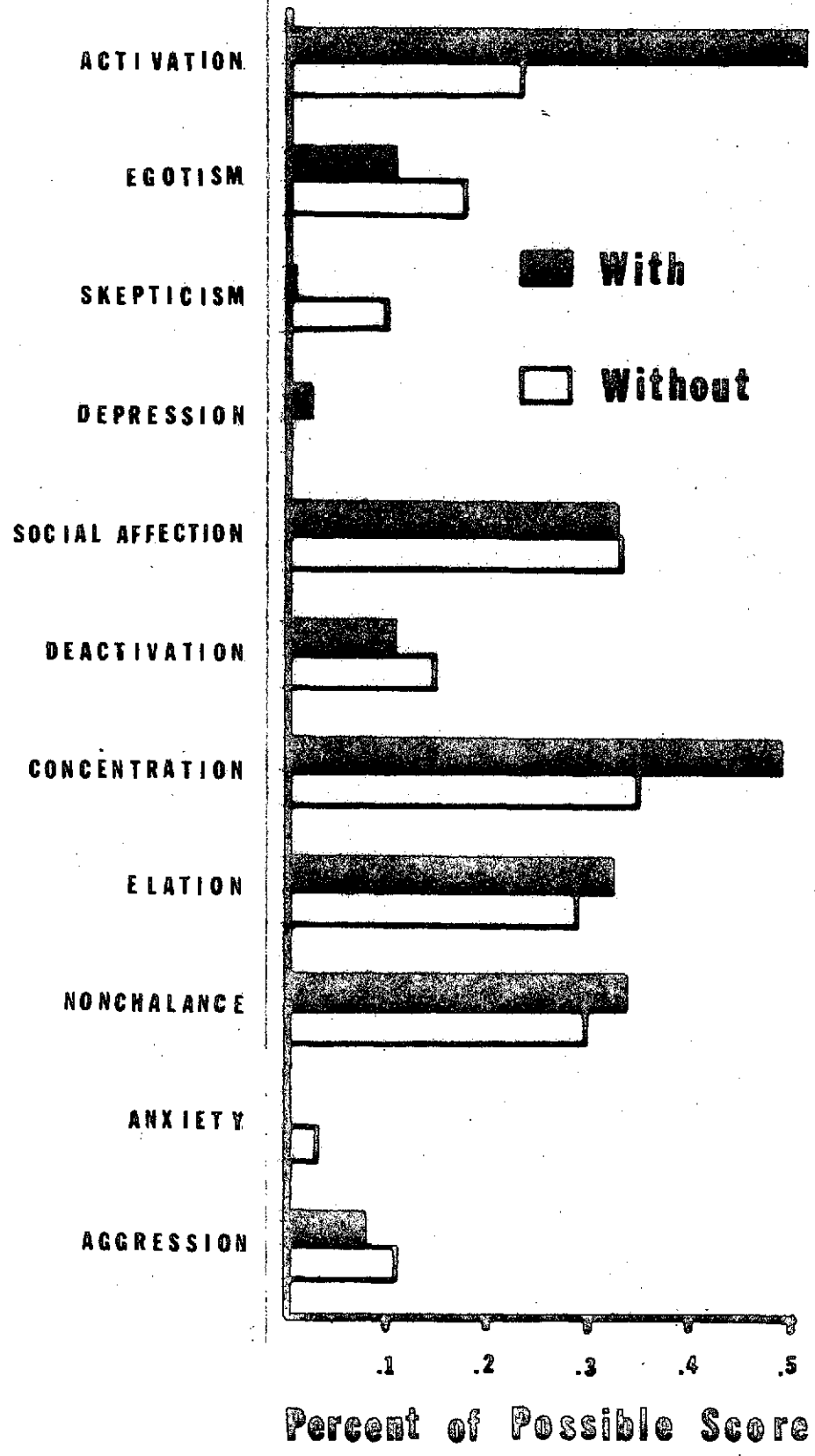


FIG. 13 Extent of elevation of each of the eleven factors of the Mood Adjective Checklist during isolation. The "with" group consisted of subjects provided with a complete complement of furnishings and decor items during the first two days of isolation. The "without" group was provided with minimal furniture and no decor items during the first two days. The score for each factor is the mean of 10 samples for each of the four subjects during all five days of isolation. The range of possible scores is from 0.0 to 1.0, with 1.0 representing the maximum elevation of a factor.



Percent of Possible Score

TABLE XXIII  
 AVERAGE MOOD ADJECTIVE CHECKLIST SCORES  
 FOR THE FIRST TWO DAYS OF CONFINEMENT

MACL FACTORS	SUBJECTS WITH FURNISHINGS	SUBJECTS WITHOUT FURNISHINGS
AGGRESSION	.09	.14
ANXIETY	.00	.05
NONCHALANCE	.29	.32
ELATION	.27	.24
CONCENTRATION	.50	.36
DEACTIVATION	.11	.20
SOCIAL AFFECTION	.28	.29
DEPRESSION	.02	.00
SKEPTICISM	.03	.12
EGOTISM	.05	.16
ACTIVATION	.50	.22

SCALE = 0 - 1.0 WITH 1.0 MAXIMUM SCORE



These times should, perhaps, be selected in relationship to certain regular events which may not always occur at the same "clock time." Two factors are important in the selection of these events; they should not be strong enough to mask out more general mood, and they should be located at some point in the daily sequence that the individual will be willing to interrupt to thoughtfully complete the form.

The Time Allocation Sample Key (TASK) was used for the first time in the group experiments. Side B of the TASK form, which is included with instructions and definitions in Appendix A, provides for the subject to record his own estimate of his state and his productivity as a function of time. This form was used daily before, during, and after the experiment. The mean scores for each of these periods for each subject are included in Table XXIV. State, or emotional energization, was found to be consistently lower during the experiments than it was before and after. This was not true of productivity. There was noticeable variation among the subjects, with some indicating greatest productivity, and others reporting lowest productivity, during the experiments.

Temporally contiguous events appeared to effect responses on the state and productivity elements of the TASK somewhat less than they affected the MACL. The problem of finding a place in

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TABLE XXIV  
 MEAN VALUES OF STATE AND PRODUCTIVITY ASSESSMENTS  
 FROM TASK FORM AND BITS PROCEDURE FOR SUBJECTS  
 OF GROUP EXPERIMENTS

VARIABLES	SUBJECTS											MEAN
	G11	G12	G13	G21	G22	G23	G24	G31	G32	G33	G34	
<u>TASK</u>												
STATE BEFORE	.42	.72	.54	.65	.65	.66	.62	.69	.62	.62	.57	.62
STATE DURING	.24	.57	.47	.64	.68	.64	.67	.68	.62	.61	.63	.59
STATE AFTER	.42	.63	.59	.62	.70	.72	.70	.81	.65	.64	.61	.65
PRODUCTIVITY BEFORE	.31	.59	.56	.58	.52	.53	.62	.62	.76	.63	.64	.58
PRODUCTIVITY DURING	.28	.54	.50	.64	.63	.56	.65	.71	.75	.78	.49	.59
PRODUCTIVITY AFTER	.23	.51	.57	.63	.59	.55	.66	.82	.76	.64	.62	.60
<u>BITS</u>												
STATE (DURING)	.58	.62	.61	.60	.60	.63	* <u>    </u>	.60	.60	.61	* <u>    </u>	
PRODUCTIVITY (DURING)	.57	.55	.49	.56	.56	.52	* <u>    </u>	.53	.51	.48	* <u>    </u>	

\*Data not collected for these subjects

the daily sequence of events when subjects were willing to work on it thoughtfully appeared to be equally important.

The front side of the TASK form allowed for subjects to indicate their participation in various activities as a function of time. Data from this form are found in Table XXV. This table permits comparison of participation in these activities before, during, and after the experiment. The largest single change is the increase in amount of time studying during. This increase is compensated by a decrease in work, other leisure, driving, personal hygiene, and sleeping.

#### NORMATIVE MEASURES

Correlation techniques were used to search for relationships among scores on certain normative scales that had been used in similar research and measures of performance, activities, and mood or state. A number of statistically significant correlations were found for the individual experiments and separately for the group experiments. Those correlations which were significant in one experiment, however, were not significant in the other! Very often a significantly positive correlation for one experiment was negative in the other, and vice versa. Inspection of the correlations among the normative scales themselves revealed the same startling instability. These data were interpreted as indicating that these

TABLE XXV  
 MEAN HOURS PER DAY SPENT BY SUBJECTS  
 IN GROUP EXPERIMENTS DOING EACH ACTIVITY  
 ON TASK FORM A

ACTIVITY	BEFORE EXPERIMENT	DURING EXPERIMENT	AFTER EXPERIMENT
SLEEPING	8.209	7.618	8.318
PERSONAL HYGIENE	1.790	1.045	1.645
DRIVING	1.990	.045	2.281
CHORES	1.509	1.881	3.063
CLASS TIME	1.218	.445	.536
STUDYING	2.618	8.990	.536
EATING	2.281	3.381	2.272
CONVERSATION	6.081	6.890	7.572
READING	.890	.854	.390
LISTENING TO MUSIC	1.427	2.636	.818
WATCHING TV/MOVIES	1.145	2.109	2.000
HOBBIES/GAMES	.190	.018	.172
SPORTS/EXERCISES	.590	.218	.809
OTHER LEISURE	2.672	.854	3.163
PSYCHOMETRICS	.172	.027	.154
WORK	2.463	.0	2.218

normative measures (16PF, EPPS, MMPI) may not be sufficiently stable indicators of the characteristics of individuals to be useful predictors of individual performance in situations similar to these experiments.

### CONCLUSIONS AND DISCUSSION

Perhaps the most general datapoint from these experiments is that the subjects were almost universally very satisfied with their stay in isolation. This is consistent with most of the other experiments conducted in this laboratory; the exceptions were experiments with minimal provisions for meaningful work. The reports from other isolation situations and studies also appear to support the conclusion that the nature of the work is one of the most important, if not the most important, of the parameters of isolation situations. Where work is adequate and satisfactory, most other parameters of the setting have less effect on overall performance and satisfaction. Where the work is less adequate, other parameters may become more critical. This relationship provides an essential perspective from which other datapoints may be viewed. The importance of other factors such as food, hygiene, decor cannot be accurately discussed without reference to the work characteristics of the situation to which they are being related. Thus, the discussion of such factors in this paper assumes a background of satisfying mean-

ingful work.

In such situations the significance of food appears to be quite high. When required, additional work is done to enhance the characteristics of food; where appropriate, considerable effort is expended in the preparation of food, and it is very frequently the subject of much discussion and minor complaining. In these experiments eating frequently occurred in an unnecessarily enriched setting. Although they could have eaten simply and quickly, subjects very often spent time and energy rearranging the setting to prepare for the meal; straightening the room, clearing the table, spreading the table cloth, providing place settings. Decor and furnishings appeared to be far more important relative to eating than at any other times! Food seems to be a very major compensation for the work and sacrifices undertaken as a part of the mission or experiment. Of the characteristics of food, the two that appear most important are freedom of choice, and the naturalness of the food, i. e., the extent to which it approximates mom's meat, potatoes, and vegetables.

While food may be said to have a positive value, inadequate hygiene facilities may have a negative value. That is, superb hygiene facilities may not increment the effectiveness of the situation, but facilities that are less than adequate are likely to be decremental. A neutral level of facilities probably provides clean uncomplicated toilet equipment, a system for daily whole body washing which

requires little effort or concentration, a means of more frequent hand cleansing, and a daily set of clean clothing. Provisions less than these may be expected to cause a proportional decrement in total effectiveness and satisfaction.

The experimental manipulation of furnishings and decor in the present study involved only 8 subjects. This limitation coupled with the scarcity of other data pertaining to the importance of decor and furnishings in isolation settings, dictates some caution in the interpretation of the data reported here. These data do, however, suggest that furnishing and decor elements beyond those required for basic comfort may not be very important, at least where work parameters are satisfactory. The exception to this general conclusion may be in the food consumption area, where some enhancement may interact positively with the reinforcing values of the food to make a positive contribution to satisfaction. In general, the absence of uniquely decorous items does not appear to have a deleterious effect, particularly if they are not expected.

The relative allocation of time among various activities in the Tektite II studies is compared with the allocation within the present studies in Table XXVI. The high degree of correspondence indicates that the present studies reasonably simulated some major aspects of real isolation settings. This correspondence is particularly significant in the case of the leisure activities, where it may be seen that the

hierarchy of use among these activities remains fairly stable. These data may probably be considered to provide guidelines for the provision of leisure activities, though there are some differences among individuals. It should also be noted that the music used was mostly familiar, the visual entertainment included movies, and reading time was usually devoted to relatively light material.

In addition to the specific, data based conclusions discussed so far, there are suggestions or inferences drawn from less formal observations during the experiments. Although the subjects were permitted almost complete freedom in their scheduling of activities there was almost no departure from a general approximation of a normal diurnal cycle. This suggests that for relatively short missions, at least, such a schedule is to be preferred.

It was frequently observed during these experiments that the nature of the interaction between the subjects and control room was critically delicate. Subjects are acutely aware of their total dependence on decisions made by control personnel, and are therefore very sensitive to any signs of arbitrariness on their part, reacting quickly and strongly to them. Such reactions noticeably affect performance either positively or negatively, depending on the direction of the deviation of interaction. Again, as seen in Table XXVI, little time is spent in subject initiated interaction with the control personnel.



TABLE XXVI  
 MEAN PERCENTAGE OF TOTAL TIME  
 SPENT IN VARIOUS ACTIVITIES

	TEKTITE II	INDIVIDUAL EXPERIMENTS	GROUP EXPERIMENTS
SLEEP	34.8	32.0	34.0
WORK	26.7	21.9	29.0
SELF MAINT.	7.7	4.1	4.0
LEISURE			
MUSIC	7.35	23.0	6.7
READING	4.02	5.1	2.7
VISUAL	7.83	8.64	6.6
ACTIVITIES	2.98	2.5	1.0
CONVERSATION WITH CONTROL	0.58	0.1	0.15
CONVERSATION WITH SUBJECT	15.1	0.4	26.0

It is thus strongly recommended that deliberate study should be directed toward both the extent and nature of this interaction. One aspect of isolation settings that has received very little mention as a formal parameter worthy of attention alongside elements like space and decor, is procedure. Factors concerning the nature of procedures, schedules, and instructions may in fact be more or less well designed and have a consequent interaction with other design variables. Certainly they must be incorporated among the terms of any general model of isolation performance. Future studies of isolation settings should devote the same kind of attention to the nature of the effect of procedure design as is devoted to the effect of facility design. Progress is currently being made in the development of procedures for evaluating the effectiveness of man/system interface facilities. Of equal importance, however, are techniques for the evaluation of the effectiveness of man/systems procedures, including timelines, procedures, and instructions.

In summary, it appears that some of the leisure/living characteristics of the explorers' trip, and vessel, will be important. Fortunately, the relative importance of these characteristics does not appear entirely unrelated to other characteristics of the environment provided for the accomplishment of his goals and his survival. Whereas yesterday's explorer was a rough hewn man whose means of travel was simple and bulky, today's adventurer sails in a delicate

craft of marvelous intricacy. The courage, strength and simple skills of the old voyager are no longer enough. Today's craft and the tasks it envelopes require great precision, vigilant information processing and quick, complex decisions. The vehicle is no longer crude and rough, oblivious to dirt and physical abuse; it is gleaming and stainless, lined on every hand with delicate instruments. Dirt and physical abuse may even result in tragic failure. Scarcely should we wonder then, that in such an environment, man wants to be clean! The long hours of reverie available to the explorer of old have been replaced by rare moments stolen from a day filled with frenetic activity. Unlikely it is, then, that anyone will be encouraged to concentrate on heavy books, only to be interrupted by one of 44<sup>5</sup> lights, bells, or sonalerts.

On the other hand, some respite is wanted, even needed, from the exciting but endless sequence of adjustments and experiments. This point is best understood, perhaps, in the context of a fleeting glimpse into the day of tomorrow's explorer. The engineer and the biologist sat (zero G jargon, stood + sat) at the table conversing quietly as they ate. The now dimly illuminated eating niche was partially separated from the rest of the craft, which even now chattered distantly with the sounds of relays and valves operating busily. The sounds of their conversation were almost completely immersed by the crescendo in the familiar Tschaikosky concerto they had selected

as the chemist joined them, fresh from a relaxing .2 hrs in the body washer. As he spread a generous layer of catsup on the steak he had selected and put in the microwave oven earlier, he grinned. That unique expression of his could mean only one thing; the design of the experiment he had been authorized to do tomorrow was suddenly beginning to fall in place.

The physicist, meanwhile, could scarcely be observed to move at all. It had been a tiring but exciting day, supervising the transmission of 231.6 megabits of data that would be used to formulate a truly universal constant for the speed of light. He had been eating quietly, staring absently for awhile at the delicate slab of real oak that formed the table top, and now he gazed silently through the large port across the table. "How like man," he thought, "to bring his own familiar world with him on his explorations of this unconquered primordial cosmos." On another level, he may have been entertaining an even older question, "Is there a cosmic form that man explores and perceives, or is it perhaps but unformed chaos, for man to provide his own form and structure?"

Soon they will sleep;  
the men, but not their "home,"  
the delicate ship so like a quiescent piano.

All day this creature called "L Homme"  
had, with forty fingers  
upon her myriad keys,  
delicately played intricate melodies  
as, feverishly, he sought to find  
the tune of Allspace.....

Softly, hesitantly, the stars begin to sing  
the song L Homme has brought them

... from his home.

APPENDIX

MOOD ADJECTIVE CHECKLIST

TIME ALLOCATION SAMPLE KEY

## ADJECTIVE CHECK LIST

Each of the following words describes feelings or mood. Please use the list to describe your feelings at the moment you read each word. If the word definitely describes how you feel at the moment you read it, circle the double check vv to the right of the word. For example, if the word is relaxed and you are definitely feeling relaxed at the moment, circle the vv as follows:

relaxed v v ? no. (This means you definitely feel relaxed at the moment.)

If the word only slightly applies to your feelings at the moment, circle the single check v as follows:

relaxed vv v ? no. (This means you feel slightly relaxed at the moment.)

If the word is not clear to you or you cannot decide whether or not it applies to your feelings at the moment, circle the question mark as follows:

relaxed vv v ? no. (This means you cannot decide whether you are relaxed or not.)

If you definitely decide the word does not apply to your feelings at the moment, circle the no as follows:

relaxed vv v ? no (This means you are definitely not relaxed at the moment.)

Work rapidly. Your first reaction is best. Work down the first column, then go to the next. Please mark all words. This should take only a few minutes. Please begin.

angry	vv	v	?	no	kindly	vv	v	?	no
clutched up	vv	v	?	no	sad	vv	v	?	no
carefree	vv	v	?	no	skeptical	vv	v	?	no
elated	vv	v	?	no	egotistic	vv	v	?	no
concentrating	vv	v	?	no	energetic	vv	v	?	no
drowsy	vv	v	?	no	rebellious	vv	v	?	no
affectionate	vv	v	?	no	jittery	vv	v	?	no
regretful	vv	v	?	no	witty	vv	v	?	no
dubious	vv	v	?	no	pleased	vv	v	?	no
boastful	vv	v	?	no	intent	vv	v	?	no
active	vv	v	?	no	tired	vv	v	?	no
defiant	vv	v	?	no	warmhearted	vv	v	?	no
fearful	vv	v	?	no	sorry	vv	v	?	no
playful	vv	v	?	no	suspicious	vv	v	?	no
overjoyed	vv	v	?	no	self-centered	vv	v	?	no
engaged in thought	vv	v	?	no	vigorous	vv	v	?	no
sluggish	vv	v	?	no					

Name: \_\_\_\_\_

Time: \_\_\_\_\_

Date: \_\_\_\_\_

Place: \_\_\_\_\_

Brief resume of important events which have occurred for you in the past hour, or since you last took the ACL:



INSTRUCTIONS FOR  
THE TASK  
(TIME ALLOCATION SAMPLE KEY)

The function of this form is to provide information about the kinds of activities you are engaged in during each day, and how your state and productivity vary throughout the day. This information will be used to examine the nature of the changes that occur as a function of your transition between your usual situation and the present situation, and to detect the effects of various events within this situation. Your candid and thoughtful reporting on this form are a vital part of the total Man/Systems data bank.

WHEN TO FILL OUT THE FORM

This form should be filled out at the end of each day, preferably shortly before retiring. The following order should be used in filling out the form:

1. Activities Chart
2. State Graph
3. Productivity Graph

HOW TO FILL OUT THE ACTIVITY CHART

The chart should summarize the times you were actually engaged in various activities. For each activity listed, simply mark in the time you were actually engaged in it. Don't bother to indicate very small amounts of time, if your total participation in an activity consumed much less than an hour at any one time, simply omit it. If you find that you were engaged in more than one of these activities simultaneously, mark both (or all) of them. The categories are rather broad, and although cursory definitions are provided on the next page, you will encounter ambiguity. In such cases, use your own judgment. Since the analysis of this information concerns change, it is more important that your usage of categories is consistent than that you use them the same way that anyone else does.

HOW TO DRAW THE STATE GRAPH

Essentially, this is a picture of your "psychological state" during the waking hours of the day. This is obviously a purely subjective process. It cannot be assumed that "psychological or emotional state" means the same thing to you that it does to anyone else. Since the analysis concerns change, your information has meaning to the extent that your own definition is consistent. As a reference point, a high state, indicated by "7" on the scale, reflects great emotional activity or arousal, being "up" or elated or excited. A very low state, indicated by "1" suggests depression, or being "down", extremely bored. The extremes, "1" and "7" should represent your own rare extremes, as low or high as you normally ever get. The midpoint, "4" suggests a neutral or reference level.

#### HOW TO DRAW THE PRODUCTIVITY GRAPH

Productivity is also a subjective term, and the same consideration regarding the consistency of your own interpretation applies. The following statement provides a general reference. Productivity indicates the effectiveness of one's behavior, the degree of accomplishment. It reflects the extent to which one's present behaviors are effective in turning out a product which will benefit him or others, or in improving his repertoire of effective behaviors by gaining new skills, acquiring new knowledge or understanding, or forming better relationships with others. High productivity, ("7") would represent wise investment of the resources, energy or time available to the individual in the present situation. Low productivity would represent the waste or useless depletion of the same resources, energy, or time. As in the state graph, the extreme levels ("1" and "7") represent the extreme variations in your own experience.

#### DEFINITIONS FOR THE ACTIVITIES CHART

- SLEEPING: in bed with no other activities in progress.
- PERSONAL HYGIENE: body care and maintenance other than food and exercise.
- DRIVING: any form of transportation.
- CHORES: required tasks not falling in hygiene, research, food related, or work; waiting.
- RESEARCH: anything immediately related to the setup or execution of experiments or data analysis.
- SCHOLASTIC: any form of study, learning, or academic reading.
- FOOD RELATED: planning, acquisition, preparation, eating, or food clean up.
- CONVERSATION: any vocal communication except lectures or speeches-- may frequently occur with other activities.
- READING: any reading done primarily for pleasure.
- LISTENING TO MUSIC: music deliberately turned on or attended to.
- WATCHING TV/MOVIES: where some degree of attention is given to the program.
- HOBBIES/GAMES: non-athletic recreation with at least semi-formal rules or procedures.
- SPORTS/EXERCISE: produces at least a little perspiration.
- OTHER LEISURE: a miscellaneous category for leisure forms not included elsewhere.
- PSYCHOMETRICS: working on feedback forms such as the present form.
- WORK: any activities required by your employment not fitting other categories; (e.g. administrative, budgets, proposals.)



