DESIGN OF A PROGRAMMED ENVIRONMENT FOR THE EXPERIMENTAL ANALYSIS OF SOCIAL BEHAVIOR

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A research environment has been designed and constructed for the experimental study of individual and social behavior over extended time periods within the context of a self-contained laboratory programmed for continuous residence by a small group of human volunteers. The environment is composed of several individual living units, a larger social living unit, and a work shop unit. Environmental-behavioral interactions are programmed by contingently scheduled sequential and optional activities, and instrumental measurement techniques provide for both quantitative and qualitative evaluations of adjustment and performance effectiveness. The focus of this laboratory research is upon the experimental analysis of human social interactions as they are related to environmental-behavioral program design factors in the establishment and maintenance of optimal group functioning. Preliminary results obtained during initial studies conducted with human volunteers participating in experiments extending over continuous residential periods up to 10 days are summarized.

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Introduction

This report describes an experimental methodology for the study of social behavior within the context of a self-contained programmed environment designed for continuous residence by a small group of human volunteers. The term programmed environment refers to a setting in which conditions exist for influencing a substantial portion of the behavior of participants. Thus, the design features of the environment are distinguished by the high degree of experimental control which is provided over variables influencing individual and social behavior. Development of this methodology is the result of the need for empirical research in the area of social functioning, the limitations of present methodologies, and the demonstrated utility of this experimental approach within other contexts.

Statement of the Problem

In a recent review of research on small groups, Helmreich, Bakeman, and Scherwitz (1973) refer to their disenchantment with the significance of the current literature as well as their depression with the general absence of excitement in the area. The vast majority of studies of social psychological effects have dealt only with acute reactions assessed over a brief period of time, and new life might be brought to the area if research could be shifted from acute experimental studies to more long-term observation of natural group functioning. Generally, non-experimental observational techniques have been regarded as most appropriate for such long-term studies of human behavior, with experimental methods deemed applicable primarily to short-term investigations. This separation of methods, however, appears to be based upon considerations of convenience and practicality rather than upon scientific utility, and need not occur.

Application of a rigorous experimental methodology involving systematic environmental design and manipulation of relevant controlling variables would certainly appear to offer the greater opportunity for determination of valid functional relationships. Clearly, the application of such rigorous methodology to the study of the complex individual and social performance repertoires involved in the continuous daily functioning of a society should broaden the applicability and generalizability of environmental design and behavior analysis principles. The opportunities for exercising the necessary degree of experimental control, however, within a functioning society are rare indeed.

The necessary research mechanism would seem to be provided by the design and establishment of an experimental microsociety environment which incorporates the broad range of naturalistic behaviors typically involved in individual and social functioning, and which is under direct experimental control. The present paper describes such a laboratory, in which small groups (up to six individuals) can be continuously maintained and studied for substantial periods within an environment designed for experimental control and programming independent of external social contacts.

Current Environmental Design Practices

Behavioral research within the context of continuous residential settings has, of course, been previously described in both the experimental and clinical literature (Ayllon and Azrin, 1968; Alluisi, 1969; Altman, Taylor and Wheeler, 1971). Little if any attention has been directed to the environmental design aspects of such investigative efforts, however, and such studies have frequently involved observation of individuals or groups within isolated environments with only limited control over relevant behavior patterns (Weybrew, 1963; Radloff and Helmreich, 1968; Helmreich, et al, 1972). The present environmental design and laboratory research program, in contrast, represents an outgrowth and extension of earlier work by Findley, Migler and Brady (Findley, 1966) in the development and evaluation of a continuously programmed environment for an isolated human subject. Their work demonstrated the feasibility of maintaining continued subject participation and productivity within such a setting, and also established that such environments can be designed to provide stable performance baselines for the conduct of systematic experimental studies under conditions which optimize control over the full behavioral repertoire. Extension of the programmed environment methodology to a social setting represents a significant advance in both environmental design and behavioral research methodology.

Environmental Analysis

The present programmed social environment makes possible both objective measurement and experimental control, two prerequisites for an experimental analysis. Objective measurement has been achieved by subdividing the total behavior repertoire into a series of behavioral units for which the frequency and duration of each can be measured via direct observation or interfacing with environmental control mechanisms. The term "experimental control" has two meanings. On the one hand, it represents the ideal of establishing a relatively constant environment in which to conduct experiments -- control of extraneous variables. On the other hand, experimental control refers to the capability to manipulate relevant variables within the laboratory investigative setting. The programmed environment described here provides for experimental control in both senses. Extraneous variables are minimized by designing a self-contained experimental environment maintained independently of external social influences. The ability to manipulate relevant experimental variables is made possible by the design of the environment and the development of the behavioral programming procedures.

The continuously programmed environment research approach described here represents, on four counts then, a significant extension of experimental methodology for the study of small groups: 1) it brings within the laboratory a broad range of complex and naturalistic units of behavior seldom submitted to experimental analysis; 2) it permits the study of conditions and processes of considerably greater duration than does the typical short-term social psychological experiments; 3) it permits direct objective observation and measurement of the behavioral units under analysis; and most importantly, 4) it permits the direct programming and manipulation of units and patterns of individual and social behavior.

The goal in the design of the physical environment has been to permit a considerable range and flexibility of research usage within the constraint of maintaining a high level of experimental control. Certain of the specific physical design characteristics result, of course, from the multiple constraints imposed by attempting, within the fixed and limited total floor space available, to satisfy a variety of specific research-related goals. These research-related design goals are reflective of our own dispositions with respect to: 1) the areas of investigation for which this laboratory is appropriate; 2) the technical style of research practice believed most likely to reveal meaningful relationships; and 3) the classes of variables which are likely to exert potent controlling influences.

Examples of specific research-related design considerations include the following. The environment should contain an array of facilities sufficient to permit the continuous residence of participants. Facilities should be sufficient for a minimum of three residents. The arrangement of facilities should permit but not demand social interaction or social living by the participants. Isolation of participants from external social contacts should be possible. Requirements of experimenters' intrusion into the environment for maintenance and materials exchange should be minimal. Provisions should exist for experimentally controlled access to physical facilities. Objective recording of participants' behavior should be provided for.

Environmental Design

The resulting experimental environment consists of a complex of five specially-designed rooms constructed within a wing of the Phipps Clinic at the Johns Hopkins University School of Medicine. The overall floor plan of the laboratory and its arrangement within the external building shell is illustrated in Figure 1. There are three identical one-room private apartments (each 8 1/2 x 11 feet), plus a large social living area (14 x 22 feet) and a workshop area (8 1/2 x 13 1/2 feet), all interconnected by a common corridor. These are arranged such that the experimenters have external access to most walls of each area. Thus, the environment is designed as "a building within a building," where research studies may be undertaken within a closed experimental social setting -- without social interactions between experimenters and subjects. Transfer of supplies and materials between the interior and exterior of the laboratory environment is accomplished via placement in two-way storage facilities accessible from both sides. The various areas of the environment provide the necessary sets of facilities to permit the experimental scheduling and assessment of a wide variety of both individual and social performance repertoires.

Each living area (both private and social) is a complete, self-contained residential unit, containing all fixtures and furnishings necessary to permit continuous, uninterrupted occupation by participants. These fixtures and furnishings consist of both the necessary utilities for biological maintenance

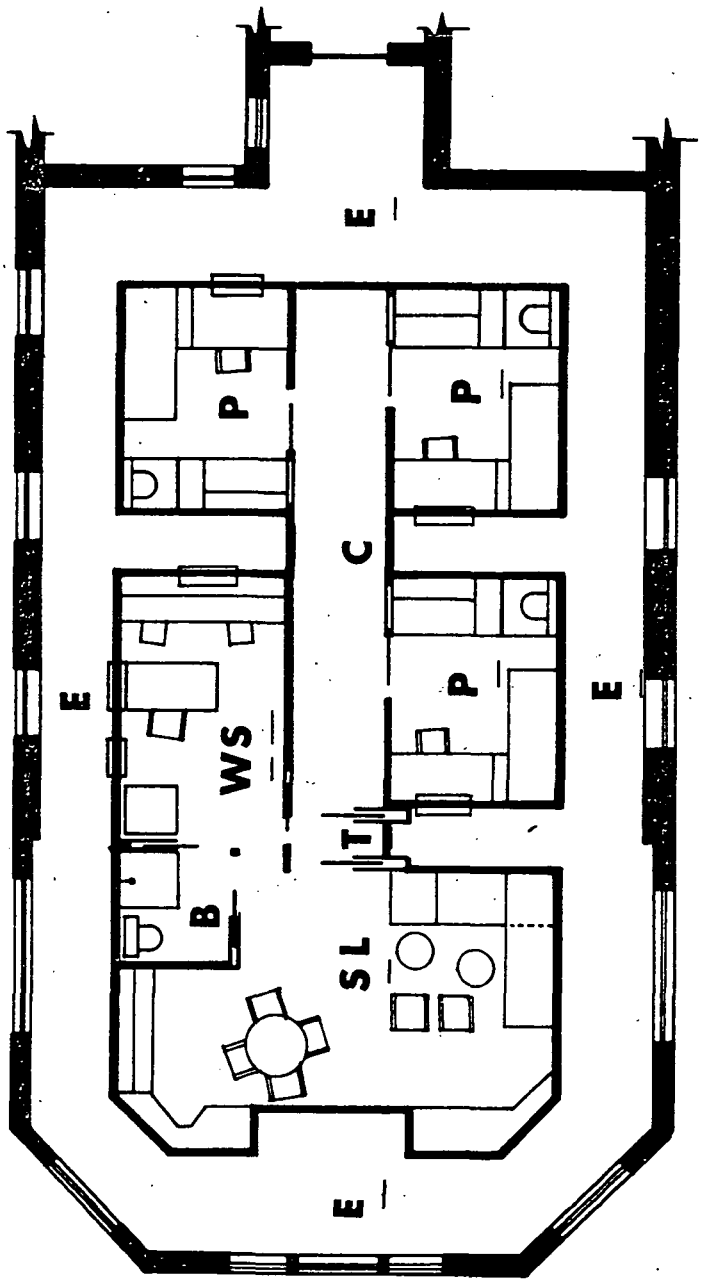

Figure 1. Floorplan of the programmed environment laboratory, showing its location within the exterior building shell. Letters P indicate the 3 private living areas. SL indicates the social living area. The workshop area is indicated as WS. The bath B, is accessible from either the social living area or the workshop. The workshop and social living area may be separated from one another by sliding doors. The corridor, C, connecting the private living areas connects to the transition cube, T, which is utilized to regulate and route subject movement within the environment. The space surrounding the laboratory, labelled E, provides experimenters with access to most exterior walls of the environment for purposes of experimental control and monitoring.

and appropriate resources for behavioral maintenance. Figure 2 presents an illustration of that portion of a private living area devoted to biological maintenance utilities -- kitchen, bath, and two-way storage facilities for the transfer of food supplies and trash between the interior and exterior of the environment.

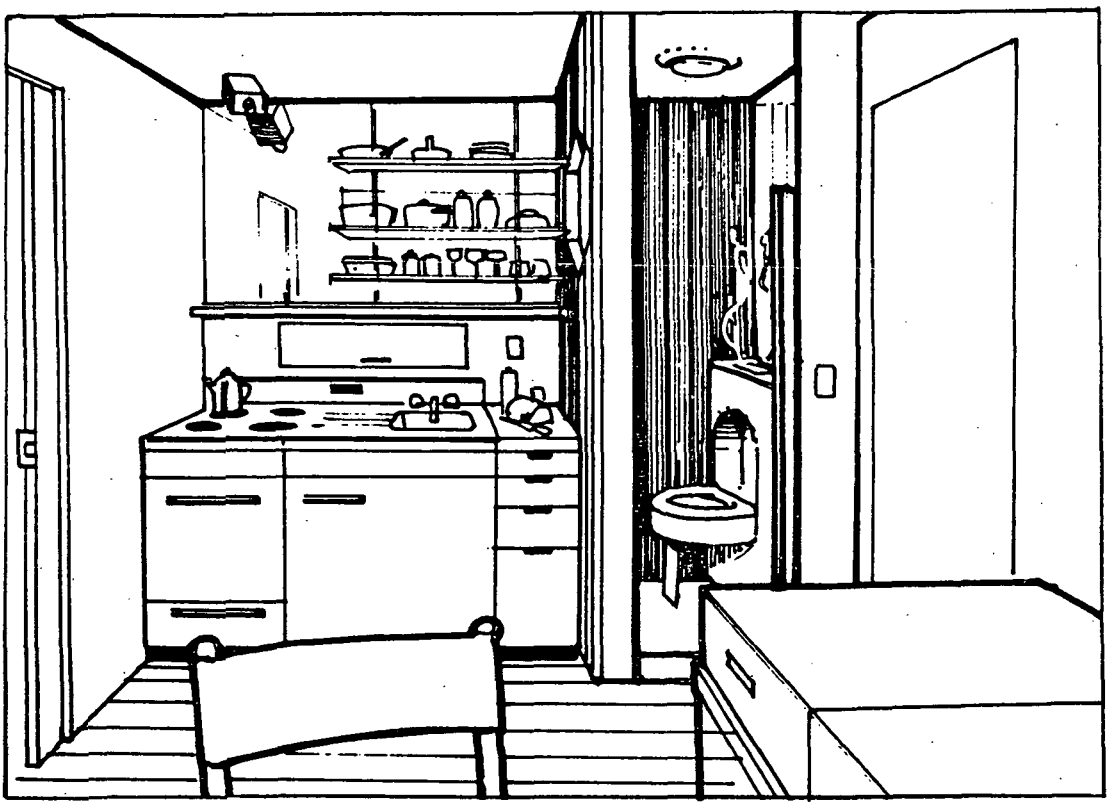

Figure 2. Within each private living area the wall to the left of the entrance from the corridor is occupied by an array of essential utilities, as shown in this perspective diagram. An efficiency kitchen provides stove, oven, sink, and refrigerator. Shelf storage is provided above, and within a column of drawers to the right of the sink. Selected drawers within this column are accessible to the experimenters outside the environment. Trash is disposed of through the panel shown above the sink. The enclosed stall to the right of the kitchen comprises a compact full bath, with sink, shower, and fold-down toilet. In the right foreground is shown the end of the bed with covers locked in place making it unavailable for subjects' use.

Figure 3 illustrates that portion of the private living areas devoted primarily to resources for behavioral maintenance -- behavioral programming, display console, communication facilities, audio entertainment facilities, work surface/desk, and an array of two-way storage facilities through which both performance tasks and recreational materials may be transferred.

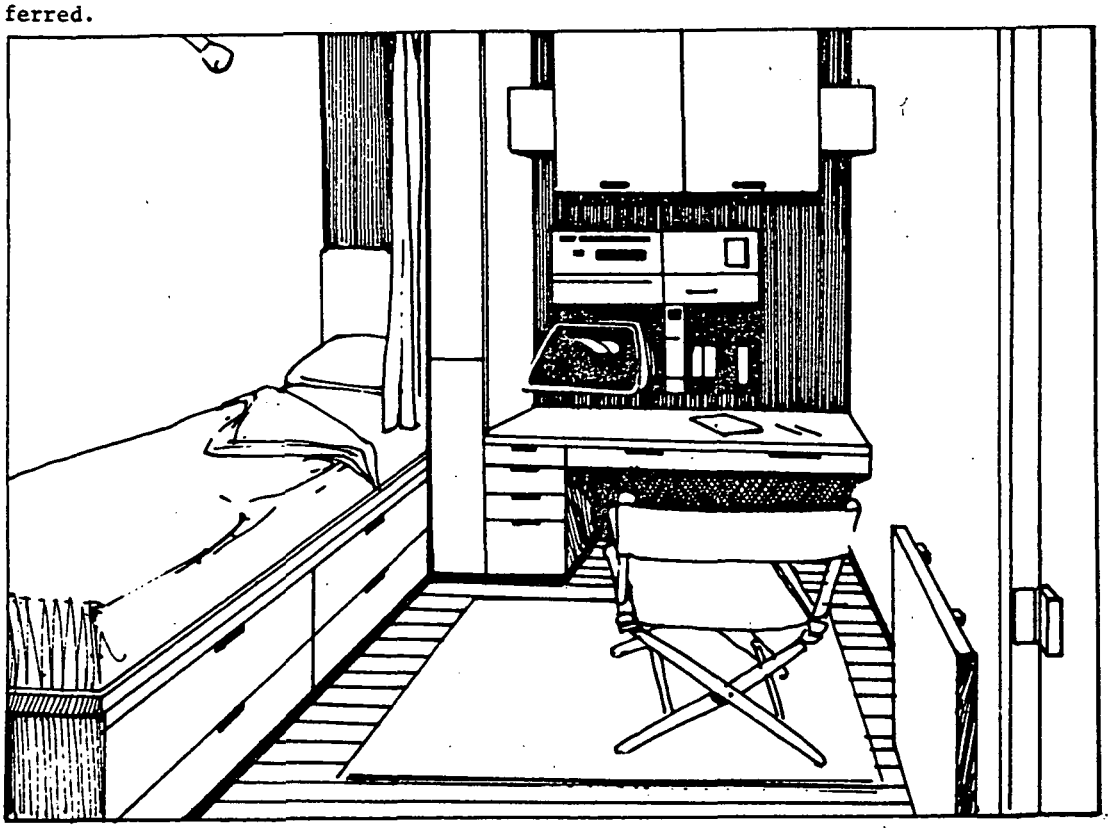

Figure 3. The wall to the right of the corridor entrance within each private living area is shown in this perspective diagram. In the left of the figure, the subject's bed is shown available for use. A vertical column of closet space separates the bed from the adjacent desk and work surface. Selected drawers below the bed and below the desk are accessible to the experimenters outside the environment. The display console above the desk contains a keyboard with cathode-ray tube video display, a stereo cassette player (speakers above), an intercom telephone system, and other stimuli and switches related to the behavioral programming procedures. Shown folded flush against the right-hand wall is an additional table surface which can be folded up for use by the subject.

Each private living area is designed to support a single individual without requiring his social interaction with others. The social living area has been designed to support three individuals living within a group context for either short or long periods. Thus, a similar array of utilities and resources are provided within the private and social living areas, though on a larger scale in the social area. Figure 4 illustrates that portion of the social living area devoted to biological maintenance utilities -- kitchen, bath, and two-way storage facilities for the transfer of food

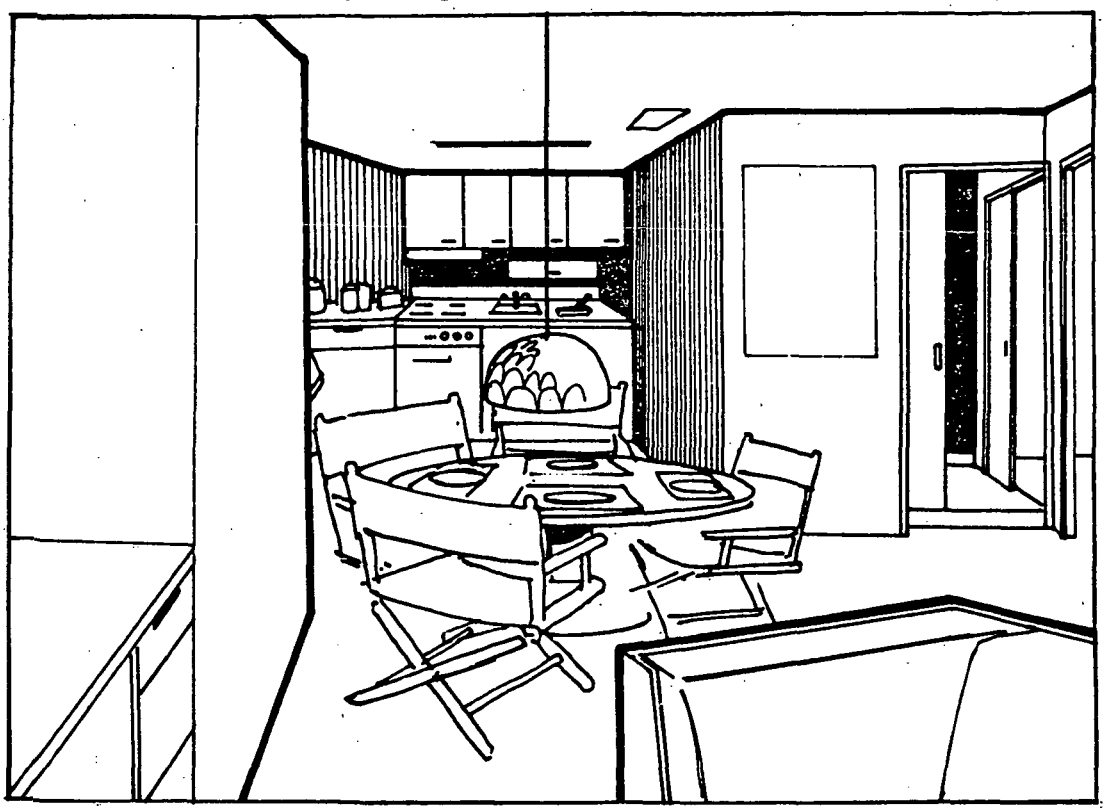

Figure 4. One end of the social living area is shown in this perspective diagram. An efficiency kitchen is provided similar to but larger than that in each of the private living areas. Storage space is provided above the fixtures and below the counter surface to the left. Selected portions of the storage areas are accessible to the experimenters outside the environment. To the right of the kitchen area is a full-size bath containing sink, shower stall, and toilet. This bath can be entered either from the social living area or from the adjacent workshop area.

supplies and trash. Illustrated in Figure 5 is the opposite portion of the social living area which is devoted to resources for behavioral maintenance. These include a lounge area which can substitute as a sleeping area, a behavioral programming console, audio entertainment facilities, desk and work surface, and an array of two-way storage facilities for transfer of performance tasks and recreational activities.

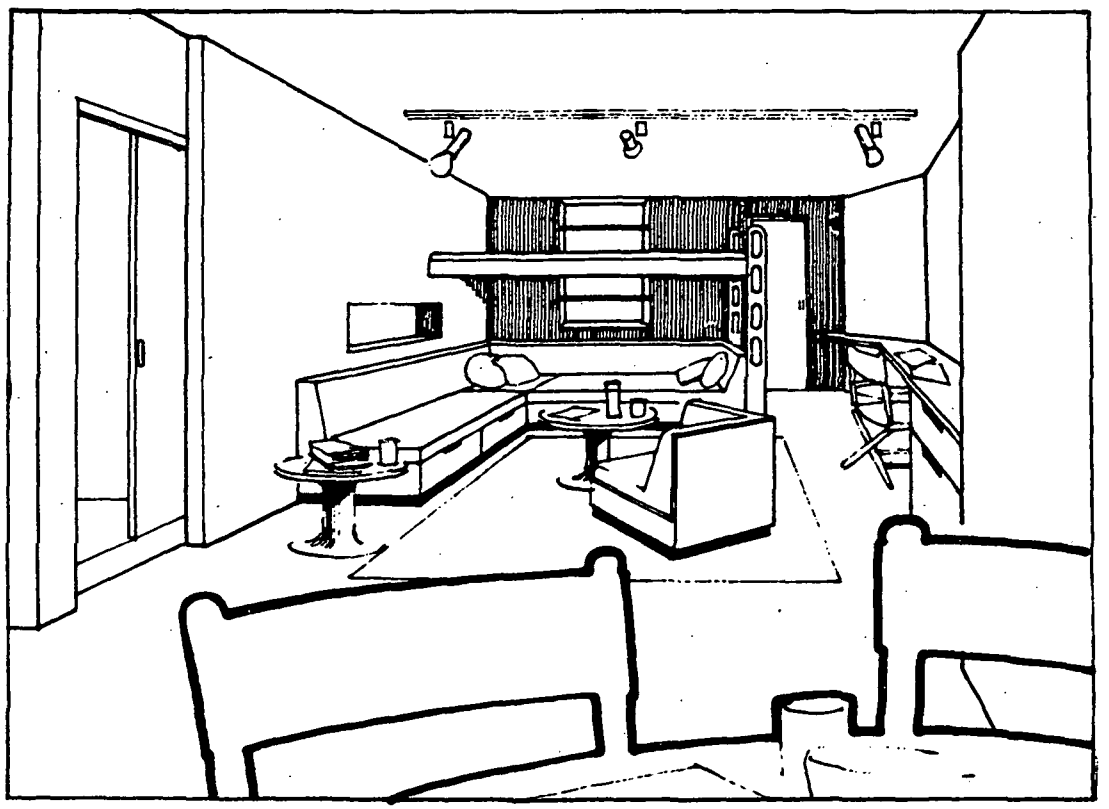

Figure 5. The end of the social living area opposite the kitchen facilities as shown in this perspective diagram. The double-deck L-shaped sofas can provide sleeping space for three individuals. A desk/work surface is located along the right-hand wall, above which is a display console (not visible in Figure) with CRT display similar to that in the private living areas.

Figure 6 illustrates the resources available in the workshop area. Again, as in the private and social living areas, a console including behavioral program display and communication facilities is provided. Also, a large array of two-way storage facilities for the transfer of supplies and materials is provided. The workshop area provides resources for engagement in a wide range of work and recreational performances which may be pursued either individually or socially.

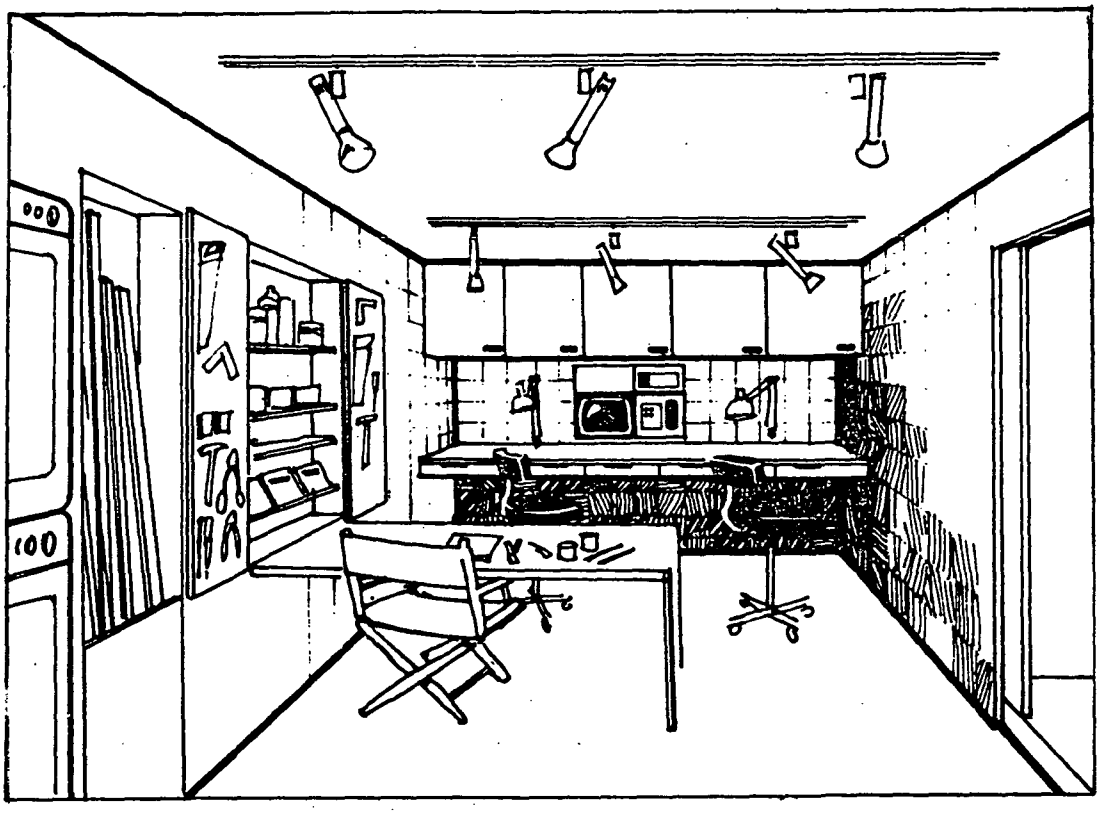

Figure 6. The workshop area is shown in this perspective diagram. The entrance to the transition cube is shown in the right foreground. The far wall provides a work-bench with storage drawers below and storage cabinets above. A display console, with CRT display, similar to those in the private living areas is provided. The two cabinets along the left-hand wall, when closed, are accessible to the experimenters outside the environment, and are utilized for transfer of materials between the interior and the exterior of the environment. In the left foreground is located a vertical washer-dryer combination for subjects' laundry requirements.

A primary consideration in the environmental design and in the behavioral program design has been the association of behavioral units with specific elements of the physical facility. A series of remotely controlled solenoid locks throughout the environment place access to the various facilities and areas of the laboratory under experimental control. Thus, since particular behavioral units require access to particular sets of environmental facilities, control over the physical facilities of the environment is translated into control over behavioral units. For example, access to the storage area containing materials for a specific activity (e.g., work supplies or reading materials) is permitted only when that particular work or reading behavioral unit is scheduled. Correlation of behavioral units with physical facilities emphasizes the requirement for integrated environmental design research in establishing experimental control under such laboratory conditions.

Social interactions within the environment can be regulated in the same manner as other behavioral units — by controlling operations of or access to the relevant physical facilities. Included as part of the display console in each room, as shown in Figure 3, is a group of communication facilities. These include a telephone intercom for communcations within the environment and potentially with the experimenters, an audio monitor system permitting subjects to listen in on other locations within the environment, and a video monitor system which permits subjects to view other areas within the environment or to view program material selected by the experimenters. Subject movement within the environment can be similarly regulated. For example, engagement in socially-defined behavioral units requires access to specific social areas of the environment. Remotely controllable solenoid locks on all doors prevent unscheduled movement. Upon entrance to, or departure from the social living or workshop areas, subjects must pass through a "transition" cubicle, illustrated in Figure 7, for identification and routing to the appropriate room (see Figure 1). This transition cubicle constitutes an "air lock" chamber to verify that each subject who passes through is identified and routed only to scheduled areas.

The electromechanical environmental control devices are interfaced with a minicomputer for remote scheduling and determination of environmental functioning capabilities. In addition to control of environmental facilities functioning, the computer can concurrently accumulate data and provide schedule information or instructions to the participants via cathode-ray tube (CRT) displays within each room. The alpha-numeric keyboard on the displays provides participants with the capability of direct communication with the system control to indicate initiation of behavioral units and to indicate individual activity selections when options are presented in the behavioral program. These subject responses on the CRT keyboard can automatically activate the relevant facilities and begin automatic data recording. In addition to these data, audio and video monitoring equipment in each area of the environment provides experimenters with continuous information concerning all subjects' activities.

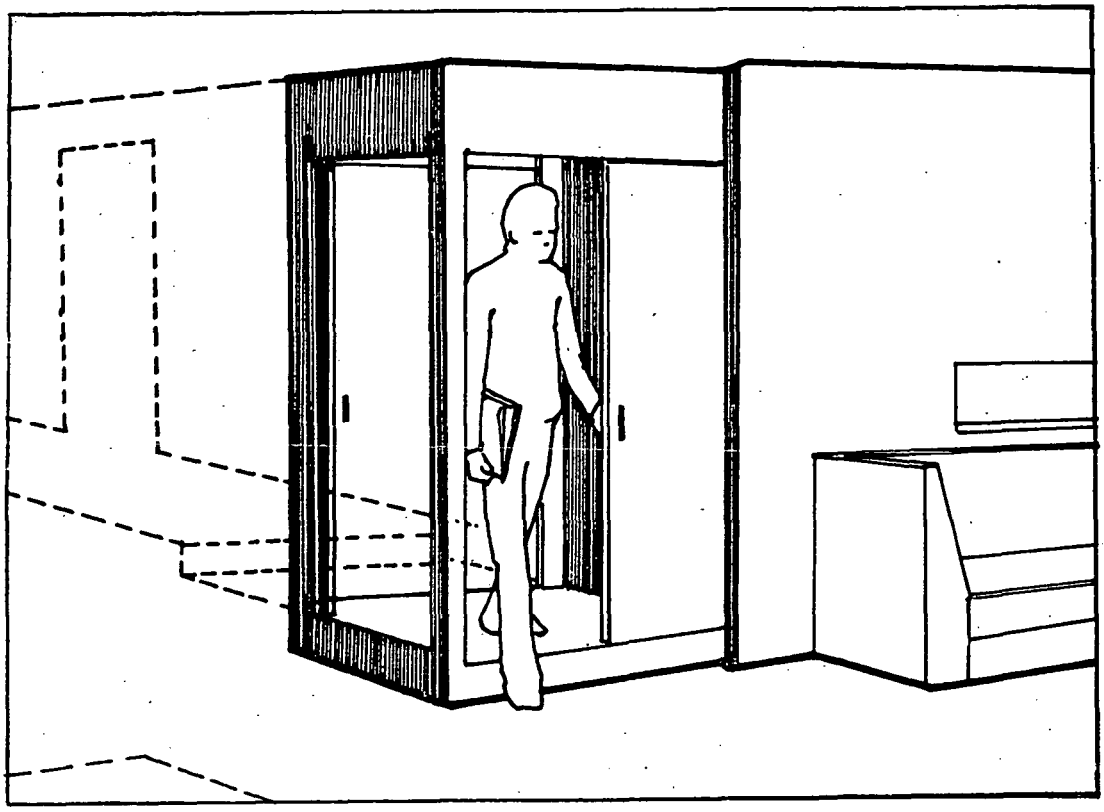

Figure 7. A schematic representation is shown of the transition cube (T in Figure 1), which is utilized to regulate subject movement among the different areas of the environment. Represented in this view is a subject exiting from the transition cube into the social living area.

Integration of Behavioral Programming

Although control of access to the physical facilities associated with behavioral units contributes to the development of a behavioral program, the term "behavioral programming" refers to more than just the automation or remote control of physical facilities. Behavioral programming refers to the experimental scheduling of behavioral events.

The aim of behavioral programming is experimental control -- for two purposes: 1) to establish stable performance baselines upon which the effects of manipulated variables may be revealed; and 2) to permit the direct manipulation of performance as an independent variable.

A behavioral program can be conceptualized as consisting of two components: 1) the array of activities or behavioral units included; and 2) the rules which govern the inter-relationships between these activities or units. These elements provide the ingredients and structure by which the controllable characteristics of the environment are translated into experimental control of behavioral units. Table 1 summarizes the behavioral units in a typical program.

The nature of the particular behavioral program selected for use is determined by the nature of the particular problem under experimental study. A multitude of behavioral programs can, of course, be developed which lie along a continuum ranging from the relatively impoverished minimum ecology necessary to sustain an individual, to as rich, varied, and complex a program as environmental resources will permit. Clearly, an interplay will exist between the complexity of the inventory of activities and the potential complexity of the rules which may govern their inter-relationship. As the inventory becomes more extensive, the rule structure may become more intricate. Thus, it should be emphasized that behavioral programming does not necessarily imply the rigid, lockstep scheduling of a repetitive sequence of activities. Behavioral programming is a very flexible procedure which can be utilized to obtain a variety of different environmental interaction patterns, ranging from a rigid and repetitive sequence to complex branching problems including a multitude of personal options.

One prerequisite for behavioral programming is that the available behavioral repertoire be subdivided into manageable units. An effort has been made to specify behavioral units which possess some operational or functional unity. Thus, broad environmental interaction categories have been selected for analysis rather than more detailed moment-to-moment qualities of performance.

The intent has been to design and establish an environment in which behavior will occur as a function of conditions and contingencies prevailing within the social group, rather than as a consequence to subjects' unique individual histories outside the experimental setting. This statement is not intended to denigrate the significance of individual differences, but rather to indicate that control was sought over variables sufficiently potent to reveal their effects despite individual differences. Thus, the major class of variables with which the rule structure deals is that of the temporal, sequential and contingent relationships among behavioral units -- the specification of the times and durations of activities, of the order in which activities occur, and of which activities are required to gain access to other activities. These are a class of relationships which have been demonstrated to exert powerful control over behavior, but which have not been generally accessible to detailed experimental control and manipulation within the context of a programmed environment designed for continuous residence.

TABLE 1

INVENTORY OF BEHAVIORAL UNITS WITHIN REPRESENTATIVE PROGRAM

Abbreviation of Unit	Full Name of Unit	Brief Description of Behavioral Unit
H ✓	Health Check	Temperature, pulse, subjective report
PE	Physical Exercise	Light Calesthenics, 10 minutes
TO	Toilet Operations	Use of bathroom and contents of TO drawer - toiletries, clean clothing
AB	Autogenic Behavior	Relaxation and concentration exercises on tape
FD 1	Food One	Two selections from a list of light foods
WK 1	Work One	Social, cooperative paced contour tracking task
SLP	Sleep	Unlimited use of bed surface
WK 2	Work Two	Varied problems, experiments, and construction projects
PI	Programmed Instruction	Access to book or programmed material
PA	Puzzle Assembly	Social, cooperative assembly of a puzzle
MB	Manual Behavior	Access to art materials
MU	Music	Earn one cassette tape
SR	Social Recreation	Social, access to games in social area
FD 2	Food Two	Private major meal
FD 3	Food Three	Social, major meal in social area
REQ	Requisition	Earn delayed delivery of treats or replenishment of consumables
COM	Communication	Access to intercom
LTO	Limited Toilet Operations	Access to commode

The rule structure that has been adopted in our preliminary efforts to develop a satisfactory baseline behavioral program is modeled after a chained schedule of reinforcement such as was successfully employed with a single participant in a previous study by Findley, Migler and Brady (Findley, 1966). In that study, chains or sequences of activities were presented, and all of the requirements associated with one activity had to be completed by the participant before

the next activity in the sequence became available. Both fixed and optional activities were available, and the activities were generally arranged sequentially in such a way that more desirable activities followed less desirable activities. These contingent relationships between activities, the sequential arrangement of activities, the distribution of scarce environmental resources within the total repertoire, and the precise stimulus control and measurement associated with each activity illustrated the application of fundamental behavior principles to the maintenance of a complex human repertoire.

An alternative rule structure which might be implemented and evaluated involves programming by economic rather than sequential contingencies (e.g., Ayllon and Azrin, 1968). Economic and sequential contingencies can be viewed as related techniques existing on a continuum. In fact, most economic or sequential rule structures will involve elements of the other. In the present case, a predominantly sequential contingency arrangement has been seen as providing the more precise degree of experimental control over behavior environment interactions.

Functional Interaction Between Environmental Design and Behavioral Programming

In the present research project, behavioral programs have been selected whose activity inventories interact optimally with environmental design features which provide for a broad range of individual work, education, personal hygiene and sustenance activities, a variety of direct (i.e., face to face) social work and recreational activities, as well as more indirect social interaction via intercom communication. Thus, these activity inventories are intended to provide a rich ecological setting which incorporates a variety of naturalistic behavioral units such as may typically be involved in complex individual and social functioning.

Figure 8 presents a diagrammatic representation of the rule structure which has governed the temporal and contingent relationships among the behavioral units described in Table 1. Each box within the diagram denotes a specific behavioral unit. Subjects progress through the program temporally from left to right. This is a branching program containing a fixed activity sequence and an optional activity sequence. Regardless of the sequence selected, the diagram represents that all behavioral units are scheduled on a contingent basis one to another, such that access to a succeeding activity in the program demands satisfaction of the requirements associated with the preceding behavioral unit.

For illustrative purposes, a detailed description of the functioning of this program follows. This particular program has been designed for and utilized with groups of two participants. In these early applications, the corridor connecting the two private rooms has served as the social area for direct social engagements. In addition, this program has been utilized in advance of achievement of the full level of automation of environmental facilities described earlier. Although this behavioral program has, thus, not utilized the full range of the environmental design facilities and capabilities, a description of its functioning can serve to clarify the nature of this experimental approach.

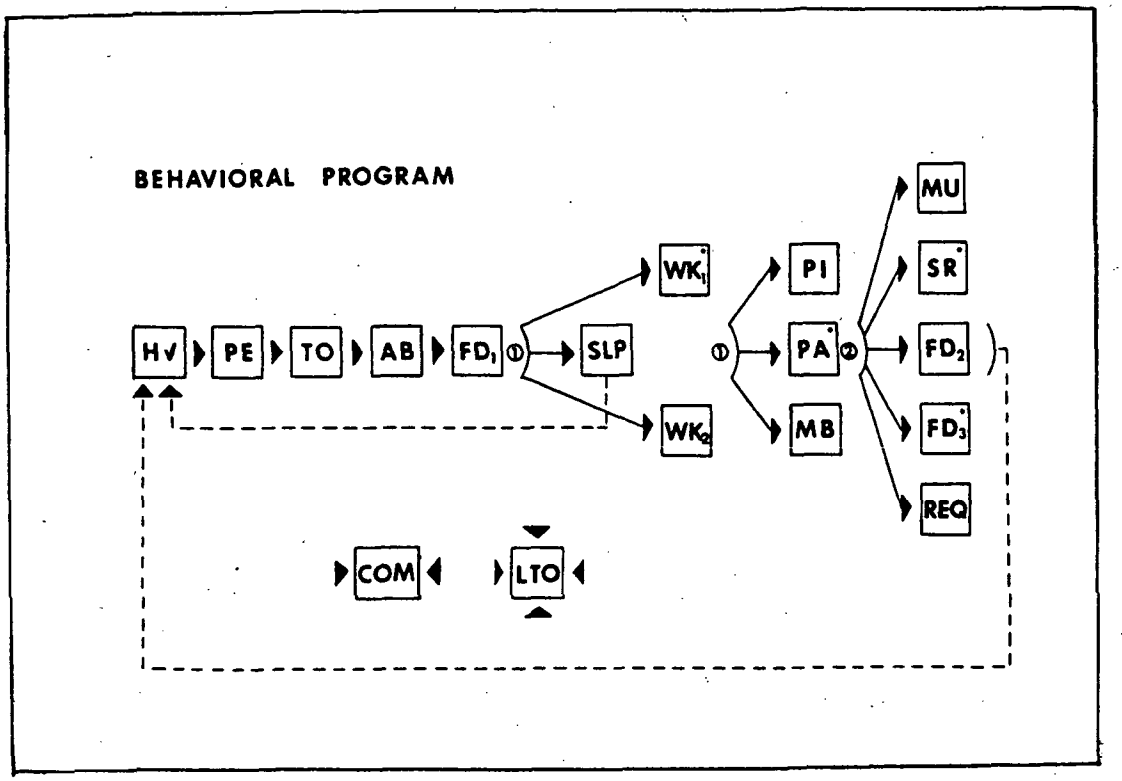

Figure 8. Diagrammatic representation of the rule structure governing the temporal and contingent relationships between behavioral units as designated in Table 1.

Beginning at the left of the Behavioral Program diagram (Figure 8), the fixed activity sequence is composed of all activities between and including H ✓ or Health Check, and FD 1 or Food One. The Health Check activity requires the subject to take his temperature and pulse, and to fill out a subjective status questionnaire. Once a subject has selected and completed Health Check, he then completes the following activities in the order displayed: PE or Physical Exercise, in which 10 minutes of light calesthenics are required; TO or Toilet Operations, allowing access to the bathroom and a drawer containing fresh clothing, towels, toiletries, and a vacuum cleaner; AB or Autogenic Behavior, in which the subject follows a taped relaxation and concentration instructions; and FD 1 or Food One, in which the subject is permitted to select two items from a list of eight light foods such as coffee or tea, soup, cereal, etc.

When Food One is completed, the subject is eligible to select one of the following three activities: WK 1 or Work One, in which the subjects enter the social area simultaneously to operate the cooperative paced contour tracking task; SLP or Sleep, which allows access to the bed for an unlimited time; and WK 2 or Work Two, which requires the subject to complete various problems, experiments or construction projects presented in the Work Two drawer. If the subject chooses Sleep, the dotted line on the diagram originating below the Sleep notation indicates that he is required to return to the Health Check activity and resume the fixed activity sequence at the completion of Sleep. Thus, this minimum recycling sequence is composed of activities designed to maintain and assess the subject's health if he is otherwise indisposed to engage in the broader selection of behavioral opportunities available within the full behavioral program.

The optional activity sequence commences with the choice of either Work One or Work Two instead of Sleep. At the completion of either Work One or Work Two, the subject is eligible to select one of the following three activities: PI or Programmed Instruction, involving a minimum of 30 minutes access to books and programmed educational material contained in the PI drawer; PA or Puzzle Assembly, in which subjects are required to assemble a puzzle together within the social area; and MB or Manual Behavior, involving a minimum of 30 minutes access to art supplies contained in the MB drawer. At the completion of the selected activity, the subject is then eligible to select, one after another, two of the five activities presented in the last column of the behavioral program: MU or Music, allowing the subject to earn a cassette tape that can be played at any time during the program; SR or Social Recreation, allowing the subjects to enter the social area simultaneously to engage in games or visit together; FD 2 or Food Two, providing the subject with a major meal; FD 3 or Food Three, providing to each subject a major meal to be consumed socially within the social area; and REQ or Requisition, allowing the subject to earn points exchangeable for treats such as soft drinks, pastries, alcoholic beverages, etc., or for consumables such as soap and toothpaste. Once the subject has completed the second of his two choices among these five activities he returns to H ✓ and resumes the fixed activity sequence, as the dotted line originating after the last column of activities on the behavioral program diagram indicates. Thus, the optional activity sequence allows the subject a degree of flexibility with respect to the selection and arrangement of activities, both individual and social, that become available at the completion of the fixed activity sequence, and provides a broad selection of individual and social work and recreation activities.

At the bottom of the Behavioral Program diagram are presented two additional activities: LTO or Limited Toilet Operations, allowing access to essential toilet facilities; and COM or Communication, allowing access to the intercom.

The Limited Toilet Operations activity is the only activity that can be selected at any time within the behavioral program and thus interrupt an uncompleted behavior unit.

A subject is permitted to use the intercom to initiate or answer a communication only if he is between any two activities within the behavioral program. That is, the interruption of an uncompleted behavioral unit to engage in Communication is not permitted. Such restricted access to the intercom is thought to provide more sensitive measures of communication dispositions as reflected in overall frequency of both calls and answers, delays tolerated prior to aborting Communication and entering the next scheduled activity, willingness or unwillingness to disrupt or terminate a particular on-going activity to gain access to the intercom, than had Communication opportunities been freely available. Additionally, scheduling intercom opportunities between activities serves to sharpen the stimulus control of Communication and enhance its functional integrity with respect to the other activities within the behavioral program. Finally, an actual conversation requires both subjects' simultaneous presence within the Communication activity, although the location of Communication within the behavioral program could be different for each subject. Intercom communcations can occur between activities although subjects may be located at different sequential positions within the total repertoire. For example, a Communication might occur when one subject is between Autogenic Behavior and Food One, and the other subject is between Manual Behavior and the last column of activities, and so on.

All social activities other than Communication require a more specific synchronization of schedules. To engage in Work One, Puzzle Assembly, Social Recreation, or Food Three, both subjects are required to be simultaneously present at the respective location in the program before the activity is made available. Typically, the subjects will arrange by intercom to meet for a social activity several items in advance, then pace their tempos as appropriate to adjust for any existing dissynchronies in their schedules.

This general programmed environment design is currently being evaluated in studies concerned with the successful maintenance of sustained small group performance under conditions of continuous residence in the experimental environment for extended periods. Of particular research interest have been the effects of temporal and social factors on group performance under such conditions, and preliminary experiments have been designed to assess variations in the rate of progression between behavioral units as this may influence social activities. The design of the environment and behavioral program permit experimental manipulation of such temporal factors by controlling the interval required to elapse between the termination of one behavioral unit and the initiation of the succeeding activity. Under such conditions for example, it is possible either to permit "free pacing" by the subject participants or to program a delay or "pause" requirement between behavioral units during which no activities or environmental facilities are available for a pre-specified interval.

The effects of such a "pause" procedure in slowing the temporal progression between behavioral activities is currently under investigation in a series of experiments with groups of two subjects maintaining continuous residence in

the programmed environment for periods of 6 to 10 days. In the 6-day studies, two days with the "pause" condition in effect (i.e., 5-min delay required between behavior units) are interposed between preceeding and succeeding 2-day "free-paced" periods with no "pause" requirement. In the 10-day studies, a 3-day "pause" period requiring 10-minute delay intervals between programmed activity units is preceeded by a 3-day and succeeded by a 4-day "free-paced" condition.

Preliminary observations emerging from both experimental procedures suggest consistent effects of such temporal pacing factors upon both general and specific aspects of the social interaction patterns and the utilization of associated environmental facilties. Figure 9, for example, shows the effect of the "pause" condition upon the relative frequency of intercom use. Based upon average frequencies for 4 subjects throughout the course of two separate experiments, the frequency with which use of the intercom facilities was initiated decreased substantially during the "pause" condition, with recovery to near pre-pause baseline frequencies occurring during the post-pause "free-

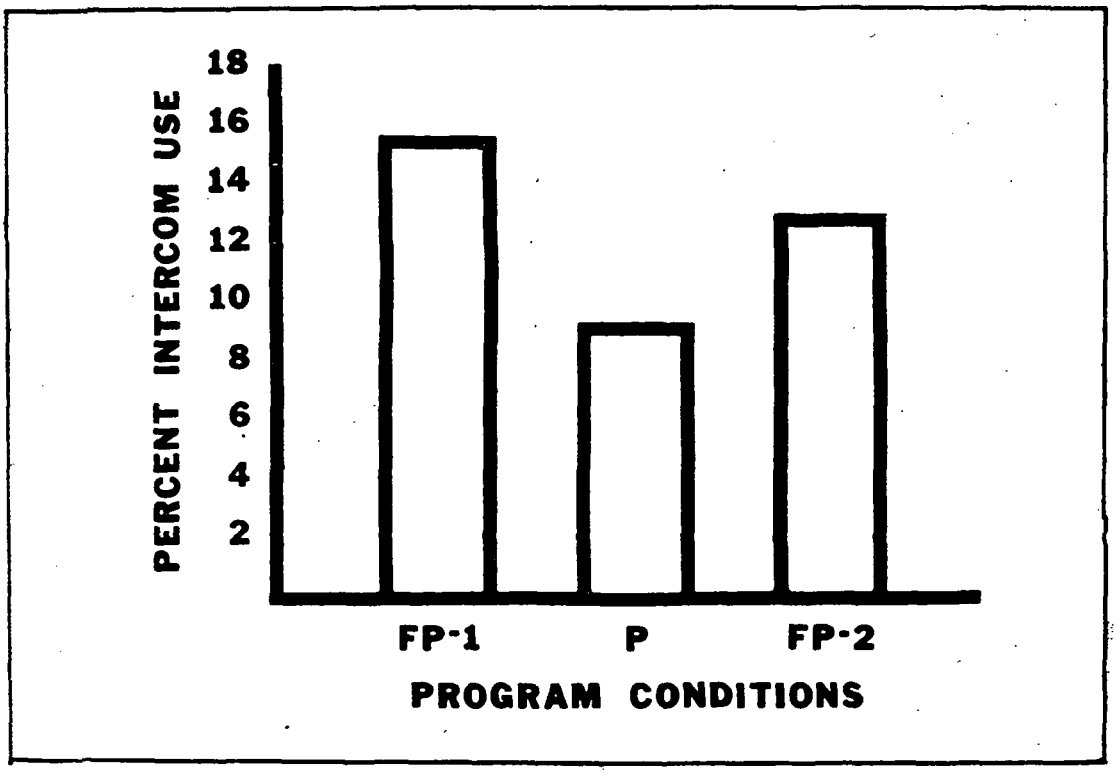

Figure 9. The effect of a "pause" requirement between behavioral units upon the relative frequency of intercom use.

paced" period. In contrast, however, the duration of intercom utilization intervals increased markedly for all 4 subjects during the "pause" condition, as shown in Figure 10, by comparison with both the pre- and post-pause "free-paced" periods. This selective increase in the duration of social interaction episodes as a function of the "pause" condition was also reflected in the Social Recreation and Food Three (social meal) measures despite the observation that the total duration of social contacts, summed across all behavioral units, decreased during the pause condition.

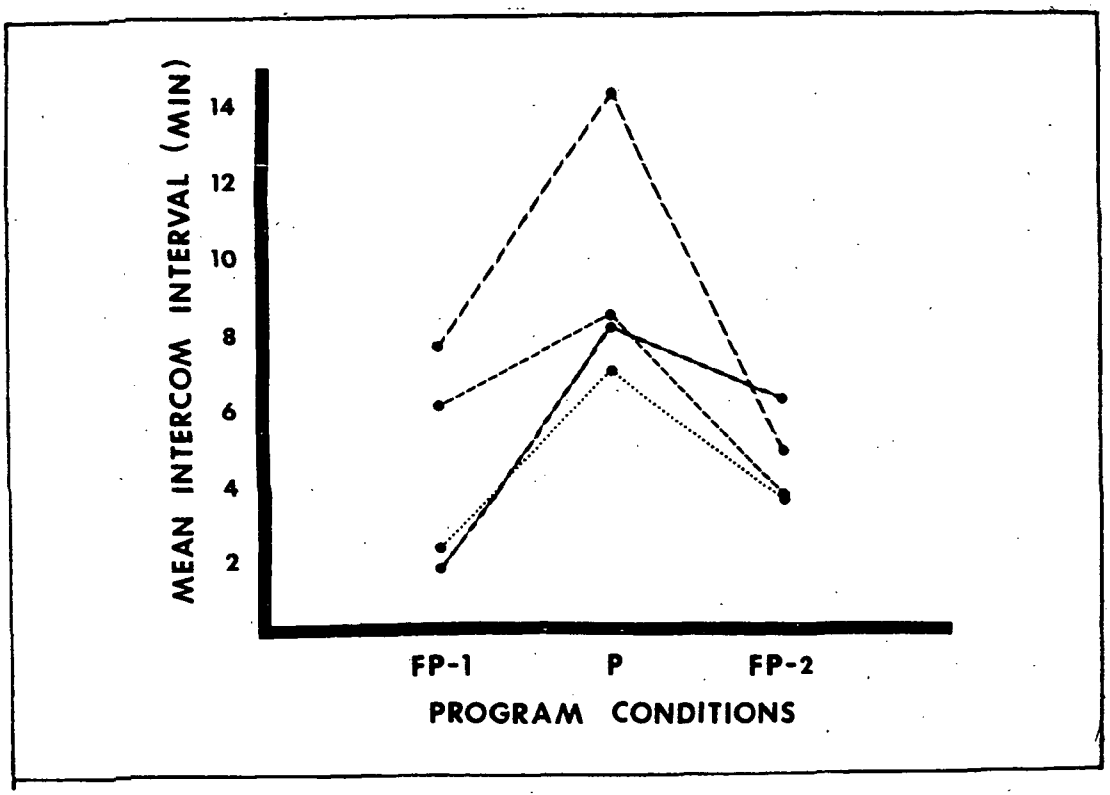

Figure 10. The effect of a "pause" requirement between behavioral units upon the average duration of intercom utilization intervals.

Conclusions and Implications

These preliminary experiments illustrate the effectiveness of an investigative methodology which integrates environmental design research and behavioral programming applications involving a broad range of naturalistic individual and social performances under laboratory control conditions for the analysis of small group functioning. Perhaps the most significant feature of this research approach to the analysis of social behavior is the high degree of experimental control which appears to derive from the combined application of environmental design and behavioral programming principles. At least four elements of the laboratory setting as presently designed appear to represent the salient features contributing to such experimental control: 1) functional separation from the external environment; 2) remote control design of environmental facilities; 3) subdivision of the behavioral repertoire into functional activity units; and 4) sequential scheduling of integrated environmental-behavioral interactions. The resulting experimental methodology promises to provide for a more rigorous analysis of environmental design and behavioral programming as such factors interact to influence human social functioning.

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Footnote

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