MANAGEABLE GROUP SIZES IN LARGE SHELTERS

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ABSTRACT

A study was conducted to determine the most effective organization of population units in a community fallout shelter. The investigation focused upon the number and levels of groups required for effective command and control in a shelter, the optimum size of each type of group, methods for the selection of leaders as well as for the assignment of shelterees, and the responsibilities of each level of shelter grouping.

The study explored the various functions of population sub-grouping, and analyzed the factors that affect the optimum size and structure of such groups in a shelter. Among the factors considered were the size of the shelter, its physical configuration, the characteristics of the population, and the availability of trained leadership.

The shelter groups that were analyzed were: (1) the Unit, a small group of around 7-12 persons, whose functions are largely related to the satisfaction of the emotional needs of the population; (2) the Section, a medium sized group of between 40-60 shelterees, in which many of the important group activities in a shelter are carried out; (3) the Division, a group of between 200-300 persons, largely concerned with management control, that is planning, coordination, and over-all supervision; and (4) the Department, the giant sized, semi-autonomous administrative group of between 1000 and 1500 persons, found only in very large shelters.

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I. SUMMARY OF RESEARCH AND RECOMMENDATIONS

The Research

There were three major research phases to this study of the organization of community groups[1] in a fallout shelter. The first stage consisted of a survey and evaluation of the literature pertaining to group size and other relevant group dimensions. The search was largely in the behavioral sciences literature, with explorations in historical and military science writings. The second phase was the analysis of the shelter system, based upon data gathered in field trips to existing shelters, shelter planning documents, habitability studies, disaster studies, and OCD and other technical documents. The third major portion of the research effort was the development of several quantitative approaches, or models, to be used to generate meaningful predictions about optimal shelter grouping, and also to verify grouping hypotheses derived from other sources.

The outputs of the study were grouping principles, grouping recommendations, and examples of sample shelter organizations. Grouping principles are theoretical statements that describe the generalized relationships between shelter groups under different shelter conditions. Recommendations are more detailed statements about the relationships between specific groups and shelter conditions. The recommendations pertaining to community groups in shelters of various sizes are combined and illustrated in the section on sample shelter organizations.

Findings and Recommendations

An important thread running through the grouping principles is the concept of the three basic functions of community groups. These are: (1) the psychological, which is the satisfaction of shelteree emotional needs; (2) the operational, which relates to the conduct of community group activities; and (3) the managerial, which is concerned with the over-all coordination and control of human and non-human resources of a shelter. Each of these

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[1] Community groups are population units of the shelter citizenry, organized for the purpose of increased manageability by shelter leadership, and increased motivation and morale on the part of shelterees. Community groups are distinct from functional groups, also known as task teams. The latter are small groups of individuals, often with specific skills assigned to carry out a particular task in a shelter.

functions can be identified primarily with a different type of community group. The groups are, in order of increasing size, the Unit, the Section, the Division, and the Department.

The Unit is the small, "primary" group which largely supports the psychological function of community groups.

Some recommendations for the Unit are as follows:

1. The recommended size of the Unit is between 7 and 12 persons.

2. The Unit is the last community group organized in shelter.

3. Shelterees should be assigned to the Unit on the basis of kinship, friendship, or common interests.

4. The Unit leader should be elected by members of the Unit.

5. The responsibilities of the Unit leader include: advising and consoling individual shelterees, and assisting Section leaders to supervise group activities and to maintain order in the Section.

The Section is the medium sized, operationally-oriented group that is the basic community group in a shelter. As far as shelter management is concerned, the Section is the formal link between management and the individual shelteree. The Section leader is directly responsible for the performance, behavior, and well-being of all members of his group.

Some recommendations concerning the Section are:

1. The recommended size of the Section is between 40 and 60 persons.

2. The Section is normally subdivided into as many as seven Units.

3. Under many conditions, the Section should be the first level of community grouping organized in a shelter.

4. Section leaders should be assigned by higher management on the basis of experience in supervising fairly large-size groups of individuals.

5. Assignment of shelterees to the Section should be on the basis of entry, that is, the time that they come into the shelter.

6. Typical responsibilities of the Section leader include: insuring that individual shelterees get fed and "watered," receive medical attention, maintain sanitary standards, and participate in training sessions; maintaining two-way communication between the shelterees and management; keeping order among shelterees; and insuring that emotional, social, and spiritual needs of shelterees are met.

The Division is the larger, management-centered community group within which the activities of up to seven Sections are planned, coordinated, and supervised.

Some recommendations pertaining to the Division are:

1. The recommended size of the Division is from 200-300 people.

2. Under some conditions, the Division should be the first group organized after shelter entry.

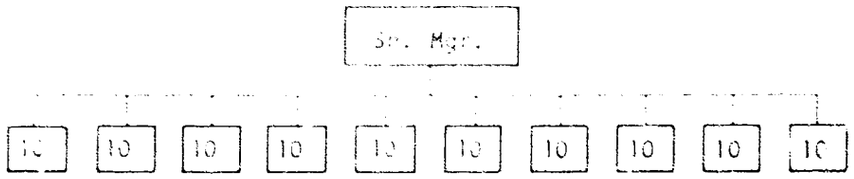
3. Division leaders should be appointed by the Shelter Manager or his core staff on the basis of prior civil defense management training or experience in the supervision of large groups of people.

4. Shelterees should be assigned to the Division on the basis of entry.

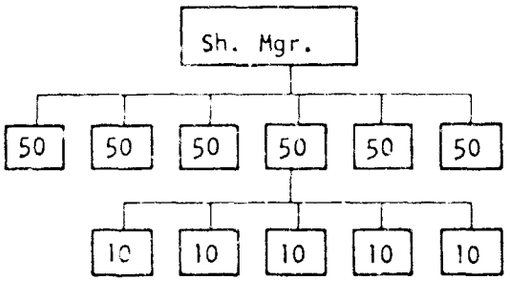
5. Typical responsibilities of the Division leader include: establishing procedures for and supervising the implementation of feeding, sleeping, medical care, emergency actions and drills, training and education, social control, and administrative requirements.

The Department is the giant-sized administrative group, found in shelters with over 3000 persons, and is desirable in shelters containing 2000 to 3000 persons. From the point of view of community grouping, the Department functions largely as an autonomous administration, much as a shelter of 1000 persons would. The recommended size of the Department is between 1000 and 1500 persons.

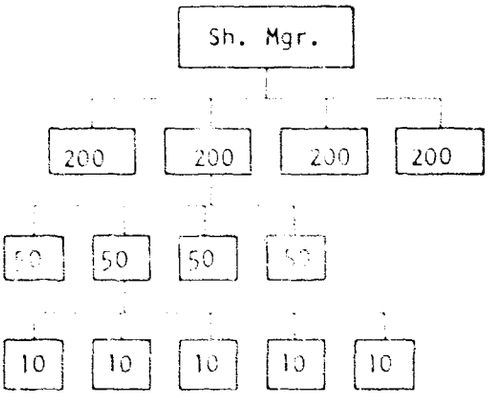
Sample organization structures were developed for different sized shelters. These charts are illustrated below. For a 100 person shelter, the following organization is recommended:



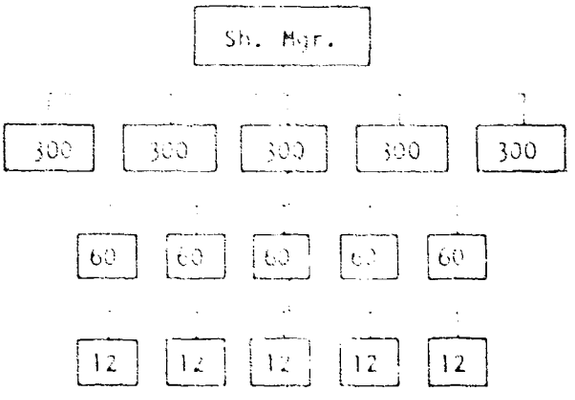
For a 300 person shelter, a standard recommendation is:



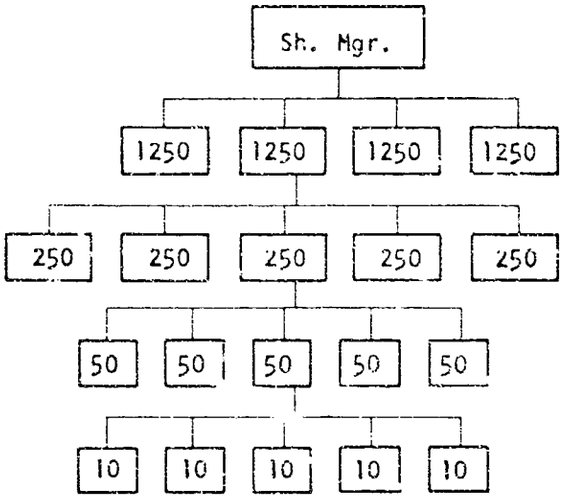
The recommended structure of community groups in an 800 person shelter is:



For a 1500 person shelter, a standard organization is:



Finally, for the shelter of 5000 persons, one of the many possible patterns of community grouping is:



The following summary points are the distillation of the grouping principles and recommendations:

1. The concept of "manageable group size," as it applies to fallout shelters, refers to more than just grouping for management or administrative convenience. The shelter incorporates most of the functions of the important groups to which we belong, in a temporary and miniature version of American Society. Therefore, community groups in a shelter must have a number of functions. Three have been identified in this study: the psychological, the operational, and the management. Each one affects and is, in turn, influenced by the others in direct and significant ways. If the emotional needs of the shelter population are neglected, it will be difficult to carry out group activities, and to maintain effective management control. Similarly, if group activities are carried out in a disorganized and ineffective way, both shelteree motivation and shelter management are bound to suffer.

Although each function should be considered in establishing a plan for population grouping, they cannot all be given equal weight in the final organization of the shelter. The functions often impose contradictory requirements upon the shelter planner or organizer. For example, the group size that ideally supports the psychological function complicates the management control problem. Therefore, community grouping must represent a compromise, between functions, resulting in a shelter organization that is in close harmony with the over-all goals of a fallout shelter--the physical survival and mental well-being of the population.

2. The results of this study do not take the form of "pre-packaged" models of shelter organization that can immediately be applied to any existing or planned shelter. The specific organizational plan for community groups in a particular shelter must reflect the characteristics of that shelter. Among the factors that must be given prime consideration are: (1) the size of the shelter, (2) its physical configuration, (3) the existence of a non-shelter organization to which many of the prospective shelterees belong, (4) the availability of trained or experienced management personnel, (5) the physical and social characteristics of the prospective shelter population such as age, sex, and social class.

3. The analysis has led us to focus upon the Section as the core community group in the shelter. In shelters with a population of roughly between 200-1000, the Section leader exercises direct supervision over the performance, behavior, and well-being of the individuals who make up his group. Interaction between shelterees and top level management is channeled through the Section head. In shelters of approximately 200-400 persons that do not have a Division grouping level, the Section will also be the management control group, involved in the planning, coordination and over-all supervision of shelter activities and resources. In shelters of over 1000, some of the operational responsibilities of the Section will be assigned to the Division, or shared by the Section and the Division. However, even in large shelters, the Section head will remain that representative of shelter management in direct contact with, and immediately responsible for, the occupants of the shelter.

II. INTRODUCTION TO THE STUDY

Purpose and Scope

The purpose of the research described in this report was to study the problem of grouping the population within community fallout shelters, and to develop recommendations for the effective accomplishment of shelter grouping. Specifically, the recommendations were to cover:

- the optimal sizes of various shelter groups,
- the methods of assignment to each group,
- the most effective type of leadership for each group,
- the in-shelter responsibilities associated with each group,
- the relationships between the various groups in the total shelter setting.

The analysis and ensuing recommendations are limited to the community group. The shelter organization is made up of two types of groups--the community and the functional. The latter, also called a task team, is a combination of individuals, often with specialized skills and backgrounds, who have been selected to carry out specific tasks in shelter (for example, a radiation team, a safety team, a sanitation team). Community groups, on the other hand, are units of shelterees that have been organized for purposes other than implementing technical operations. These purposes include: satisfying the emotional needs of shelterees, carrying out group activities, and maintaining over-all management control over the shelter.

Nature of the Problem

Man is a social animal. From his earliest days, he has joined with his fellows to solve the substantial problems of existence. An important characteristic of this tendency to form groups is that man has generally evolved different types of groups to solve different survival problems. For example, in most societies, the size, structure, and membership composition of the hunting or food-gathering group has been different from that of the child-raising group. During the course of the development of Western civilization, an ever increasing number of more and more specialized groups have arisen to share, and often compete in solving the problems of the society. This tendency is nowhere more evident than in contemporary American society. As a new problem arises, it is almost routine in American social life to form a new group to solve it. The groups that are so formed vary extensively in their size, structure, membership composition, mode of operation, and duration of existence.

The research task of this study is to analyze the many and diverse types of historical and existing groups, and to select the form of human grouping

that most effectively satisfies the requirements of shelter living; that is, the arrangement of groups that lends itself best to management control by shelter leaders, and, at the same time, meets the emotional needs of the shelter population.

It may be asked why grouping a shelter population into manageable units is an important feature of shelter planning and organization. The lesson to be derived from historical records, field studies, and experimental research on humans under stress is that survival under stress is closely tied to the presence of effective leadership, management, and group motivation. The leader's ability to direct the group towards the successful accomplishment of its goals, and the member's willingness to forego individual ends in order to unite in joint efforts towards survival, are both dependent upon effective grouping of the population.

A second question may be asked as to why it is necessary to do research on shelter grouping. If there is a universal human tendency to form into groups, may it not be assumed that this tendency will also exhibit itself in fallout shelters, and that a spontaneous organization of shelterees will emerge without the need of formal research-based recommendations?

In all likelihood, in small shelters of 100-200 people, with trained management and adequate facilities, the grouping problem will solve itself. It can also be assumed that some form of grouping will take place spontaneously in large or overcrowded shelters, in those without trained leadership, or in those with an extremely heterogeneous population. However, it cannot be taken for granted that the resultant organization will be adequate to deal with the extensive problems of shelter survival for several reasons. The first is that the shelter is an extremely complicated system. It resembles a miniature, temporary version of American society. As such, the shelter system combines the functions that in our society are normally distributed among a wide range of organized and informal groups. Included among these functions are the economic (the allocation of resources), the political (the establishment of leadership and rules, and the maintenance of order), the educational (teaching the necessary skills for in-shelter and post-shelter survival), the religious, the social, and the family.

In addition to being a complex system, the shelter is also a very delicate one, in the sense that any one of a number of conditions, both internal and external to the shelter, could rapidly upset the survival balance and endanger the population. Still another aspect of the shelter that makes it a unique form of social organization are the conditions that will very likely prevail at the time of shelter occupancy. Shelter habitation will be characterized by stress and deprivation; the amount of each will depend on the interplay of many factors, including the nature of the attack and the status of a particular shelter.

Thus, the complexity and uniqueness of the shelter system make it unlikely that unplanned, "on-the-spot" grouping can be very successful as a general procedure.

This same complexity and uniqueness also serves to complicate the research task of developing recommendations for optimum group sizes. There is no single existing type of group that can be transferred *in toto* to serve as a model for shelter grouping. The social structure of the shelter must be a composite of several different types of organizations. The predominant ingredient in this composite is the military organization. The similarities and distinctions between the military and the shelter organization in relation to group size and structure are discussed in another section of this report.

The fact that the shelter is a system established solely to cope with a possible future state of events, has implications for group size research. The shelter as a concrete social organization really does not exist until disaster strikes. This means that recommendations about group size and structure cannot be verified through direct "real" shelter experiences. The adequacy of such recommendations must be inferred through studies of natural organizations that resemble shelters, laboratory studies of groups under conditions of stress and deprivation, and through simulated shelter exercises.

Assumptions

There are two general assumptions that underlie this study:

The first has to do with the size of the shelters that are the subject of this report. The title of this final product is "Manageable Group Sizes in Large Shelters." Throughout this document, "large shelters" refers consistently to shelters of about 1000 capacity or more.

At the outset of the study, it was hypothesized that shelter management problems in the area of population sub-grouping would be directly proportional in number and in complexity to the size of the shelter. Therefore, the decision was made to concentrate the research effort on large shelters (around 1000 and larger) and on medium shelters (between 400-800).

It was recognized that a large number of existing shelters fall into our category of "small shelter," that is with a capacity of 200 persons or fewer. In many of the smaller cities, and even more in the towns and villages, there is not a single shelter that would qualify as medium or larger by our criteria. Consequently, it was considered obligatory to examine the sub-grouping needs of the 200 and under capacity shelter, even though according to our hypotheses, population grouping in such a shelter would offer relatively few problems for shelter management. Subgrouping, being an inherent characteristic of human behavior in groups, will occur in the smallest community shelter, (and also in groups much smaller than that.) However, it is important to distinguish between sub-grouping as a natural phenomenon, and sub-grouping as a leadership problem. It is our contention that reasonably effective population groupings will emerge naturally in many small shelters with little management intervention. An effective community organization in large shelters

cannot be achieved without the active participation of management, as exemplified by a plan for grouping, and by control of the grouping process. Although the small shelter has been included in the analysis, it has by design, been given less attention than the medium and large shelter.

The second general assumption pertains to the Shelter Manager. Constant reference is made in the body of this report to a Shelter Manager and to a management staff, without specifically identifying the positions or describing the duties, responsibilities, and qualifications of the title holders. The role of the Shelter Manager and the management staff is discussed in detail in other OCD reports[1], and it was deemed outside the scope of this project to dwell upon the details of these positions. However, it is necessary to mention the basic assumption concerning the Shelter Manager that underlies the grouping principles and recommendations. It is assumed, for the purposes of this report that each shelter will have a leader who is capable of directing an operation as complex as that of a community fallout shelter. Ideally, such a leader will have been pre-selected and trained in shelter management. Conceivably he may not have been trained in civil defense management, but possesses the experience to direct a fallout shelter. The Shelter Manager is responsible for the safety and well-being of the population. It is his duty to see to it that all operations and other requirements necessary for survival are carried out. Because he will not be able to directly supervise all aspects of shelter life, he must delegate authority to subordinates, by establishing a management staff. In some cases, the management staff will be selected prior to occupancy; in many cases it will be chosen after shelter-taking from among the shelterees. The size of the management staff is a function primarily of the size of the shelter. In all shelters the role of the management staff is to represent the shelter manager in satisfying shelteree needs, in implementing operations and activities, and in maintaining effective command/control of the shelter.

While it is interesting to speculate on emergent leadership and its relation to population grouping, it is at the current time exceedingly difficult to generate meaningful hypotheses about the reciprocal relationships between emergent leadership and community groups. The process of emergent leadership and the characteristics of the emergent leader in large groups is too little understood to be formally incorporated into the analysis.

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[1] Bend, E., Grifford, C. D., Schaner, Ada, & Shively, Aliza. Shelter organization and management. Pittsburgh: American Institute for Research, 1963. Eninger, M. U. Recruitment, selection, and training of shelter management staffs. Pittsburgh: American Institute for Research, 1963.

III. THE RESEARCH METHOD

The research approach utilized in this project consisted of the following tasks:

1. Review and evaluation of the literature.
2. Trips and consultations.
3. Analysis of the shelter system.
4. Development of grouping models.
5. Development of grouping principles and recommendations.
6. Verification of principles and recommendations.

The first four tasks are described in this chapter. The last two are represented by Chapters V through VIII of this report.

Review and Evaluation of the Literature

The literature that was surveyed and analyzed for this study was of two types, that pertaining to shelters directly and by extension to disaster studies, and that dealing with theory and research of human groups in the several behavioral sciences.

Documents in the latter class came from the fields of sociology, social psychology, management science, anthropology, history, political science, and military science. A summary of portions of this literature is presented in Chapter IV, Research Findings.

With reference to the first literature category, pertaining to shelters, a unified data classification scheme was established in conjunction with other A.I.R civil defense projects in order to use an expanding technical library of over 600 documents with greatest efficiency. The documents included OCD reports and books, reports on disaster research, armed services studies, translations from European civil defense studies, textbooks related to social and psychological aspects of disaster and war, technical manuals, and shelter data gathered on field trips. An elaborate code, punched on McBee cards, allowed each document to be located by document number, project number, or contents. In all, the code theoretically allowed for over 300 categories, of which about ten per cent were directly related to this study.

Trips and Consultations

During the early phases of this project, a number of discussions were held with civil defense personnel, shelter planners, and grouping experts, who provided valuable guidance in organizing the project. An extensive data gathering trip was made in August, during which time shelters in five states and the District of Columbia were visited. In the course of interviews with shelter planners and coordinators, information about shelter grouping was elicited. With few exceptions among the organizations visited, the problem of organizing the shelter into manageable units is one that had been given little consideration.

Analysis of the Shelter System

In order to develop recommendations about the size and structure of shelter groups, it was necessary, first, to systematically examine the nature of the shelter system. The analysis began with the consideration of the goals of a fallout shelter, which are the physical survival and mental well-being of the protected population. The general requirements for meeting these goals were specified. A further subdivision was made of the operations and activities that had to be carried out to satisfy the general requirements. Requirements and activities are listed in Table 1. Next, the specific tasks that made up each activity or operation were specified. For example, some of the tasks associated with the activity of feeding are: preparing food, distributing food, disposal, and clean-up, etc.

A generalized model of the shelter system resulted from this phase of the analysis and was useful for certain types of analysis. It became clear from field trips and other sources of data that the diversity in existing shelters along such dimensions as size, pre-trained management, and level of facilities was too great to be adequately handled by a unitary model of the shelter system. This led to the second phase of the shelter systems analysis, that of the shelter typology. The basic task in this stage was to identify and evaluate variables that appear to have a significant effect upon the organization and operation of a community fallout shelter. The variables that were assigned great importance were:

- size of the shelter,
- configuration of the shelter,
- shelter equipment and facilities,
- population characteristics,
- pre-trained management,
- knowing other shelterees,
- status of the external environment.

From the possible combinations of the above variables, a typology of shelter systems was developed.

Table 1

Shelter System Requirements and Activities

REQUIREMENT	ACTIVITIES
Protect shelterees against environmental threats.	1. Provide radiological defense. 2. Protect against blast and other weapon's effects.
Provide for basic human needs.	1. Control atmosphere and temperature. 2. Provide water. 3. Provide food. 4. Provide sleeping facilities. 5. Provide sanitation facilities. 6. Maintain physical and mental health.
Maximize adjustment to shelter living.	1. Increase motivation and morale. 2. Provide social and spiritual activities.
Organize and operate the shelter system.	1. Establish a shelter organization. 2. Maintain social order in shelter. 3. Establish communications. 4. Train shelterees for survival. 5. Keep administrative and logistic control in shelter.

Both the generalized shelter model and the shelter typology were important elements in the proposed model for quantitatively evaluating the importance of shelter variables and the relationships among variables.

The first two phases of the shelter systems analysis were carried out in conjunction with Contract Number OCD OS 62-164, The Organization and Management of Civil Defense Shelters. The last phase of the analysis pertained only to the present study. It consisted of identifying those shelter activities from the generalized model and those variables from the shelter typology that have an effect upon group size and structure. In addition to identifying the variables and activities, the direction and the intensity of their influence upon group size was estimated wherever possible. The results of this phase of the analysis are directly reflected in the grouping principles and recommendations, Chapters V and VI.

Development of Grouping Models

Analysis of past disasters strongly indicates that a well organized shelter population is of vital importance to survival. Such an organization should enhance management and control of the shelter population as well as provide the individual shelterees with the adequate framework for adjustment to the harsh conditions. An important prerequisite in planning for effective shelter organization is the identification of those population grouping configurations which are most amenable to management. This problem is unique in as much as it has not been studied nor documented before for similar situations. Because the problem does not exist, its study becomes even more complex. One way for overcoming the difficulty is to use simulation in order to determine optimal sub-grouping in shelters.

Some of the devices which can be used to simulate shelters are: mathematical models, descriptive models, and actual experiments through shelter occupancy studies. This section provides a review of the activities and the results of an intensive examination and evaluation of the first two approaches. (The mathematical model will be found in the Appendix.) Experimental studies were not within the scope of this research project.

The Mathematical Model

An attempt was made to develop a systematic conceptual framework, or a model, which would permit the generation of meaningful and testable predictions concerning optimum sub-grouping. In order to construct such a model, the elements of the shelter system had to be determined and the interaction of these elements expressed in quantitative terms. Three types of elements were identified: (a) functions which the shelter system must perform in order to achieve its goals; (b) conditions which may exist in the shelter; and (c) characteristics of the shelter population. It would have been desirable to develop a sophisticated mathematical model, which would provide for the examination of the comprehensive range of shelter functions

and conditions. However, the lack of adequate quantities of relevant numerical data, and the difficulties inherent in obtaining such data, suggested that this approach would, at least at present, be premature.

A tentative model, using combinations of functions and conditions, and possessing a reasonable degree of quantification, was developed. One of the underlying assumptions of the model is that various sizes of sub-groups will affect the accomplishment of shelter functions under specified conditions in at least three ways: (1) increase (or decrease) the effectiveness with which any function can be met; (2) decrease (or increase) the criticality of the function; and (3) decrease (or increase) the probability of the occurrence of the specified condition. When all shelter functions and shelter conditions are considered at one time, a measure of total shelter effectiveness can thus be derived for various sizes of sub-groups. Also, the optimum sub-grouping of shelter populations can be determined for all types of shelters.

Next, an in-house evaluation of the model was conducted to ascertain whether it was analytically sound, whether it was indeed representative of the shelter system, and whether it could accomplish its objectives. While the model seemed adequate on all three counts, the most important input was still lacking: relevant data in precise quantifiable terms on group sizes and their effect on shelter effectiveness.

A thorough search of the relevant literature including current organizational, managerial, sociological, and psychological theories revealed that data of this nature are indeed meager. Some of the literature on group behavior points to certain relationships among the various dimensions of small groups, such as their size and its relationship to the structure of the group, communications within the group, and the need for leadership. Other research deals with task performance of groups, such as problem solving and decision making. However, none of the sources consulted yielded adequate data on the effect that various group sizes would have on the accomplishment of functions similar to those performed in the shelter system.

The Descriptive Model

Because adequate empirical data were not available and it did not seem feasible to obtain acceptable judgments to complete the mathematical model, a descriptive model was considered as a framework within which to obtain simplified judgments. The descriptive model was essentially a reduction of all the general characteristics that have been identified as being important in defining differences among shelter systems to sets of categories. The question then raised was whether these categories could be used to define a sample of different hypothetical shelter systems which could be evaluated

in terms of the impact of grouping alternatives on shelteree physical survival and mental well-being.

Preliminary work toward reducing the descriptive model to evaluation procedures suggested that the complexity and number of judgments and the number of judges required in order to obtain sufficiently refined and stable results would be excessive for the purposes and scope of this project. The framework of the descriptive model was used, therefore, as an aid in structuring the problem and organizing this report, but was not used as a direct basis for obtaining evaluations of grouping alternatives.

IV. RESEARCH FINDINGS

Review of the Behavioral Science Literature

While the literature directly concerned with optimally manageable groups in shelters is not extensive, studies on small-group behavior, habitability studies, and military experiments supply considerable relevant information for implications to this problem. There are, however, few studies on large-group populations.

There appear to be four main sources of information relating to manageable groups. The first comes under the category of unstructured observation, a technique used widely where an event of sufficient interest presents itself for observation but not for scientifically controlled study. For example, an account of the activities of a group involved in a natural disaster, supplemented by interviews with members of the victim group, illustrates the unstructured observation technique. A variation on this technique is that of participant observation, where the observer is a member of the group and shares directly in the group's experience.

A second approach is that of expert opinion. In many cases, where experimentation is not feasible and observations are not available, an expert in the area in question may be asked to discuss the probable outcome of such research or observations in relation to those variables with which he is expertly familiar. Though experimental evidence is preferable, the value of opinions by experts is obvious especially where these opinions are held by several such experts.

A third source is industrially sponsored research which is generally concerned with the behavior of a group performing a specific task. This information, often experimentally derived, is frequently not directly applicable to other situations and must be considered with this in mind.

The final source is basic research on group dynamics which has been conducted in the laboratory by social scientists. These studies have investigated many variables in group relations which are of interest to the problem. There is a reservation, however, that is that most of the controlled group research has been done with groups of less than 15 individuals. This must be borne in mind when considering the research findings.

A study directly concerned with shelter habitability (Altman, et al, 1960), clearly demonstrated the wide variance in group behavior which can occur in groups of approximately equal size and under similar conditions. This emphasizes the importance of group behavioral variables which, though not as obvious as group size, have important consequences for group success and stability. In addition to over-all group behavior, another very important principle of human interaction was observed in all cases. This was "the rapid formation of sub-groups within the general shelter population. Sub-grouping occurred within minutes of shelter entry and remained relatively stable for the duration of the confinement period."

Sub-grouping is mentioned here because it represents a core principal of general group behavior and must stand high on the list of considerations relevant to group manageability. It has been shown (Baker & Rohrer, 1960; Rohrer, 1959; Entwisle & Walton, 1961; James, 1951; Kelly & Thibaut, 1954), that where specific provision for sub-grouping is not made, it will occur spontaneously on the basis of acquaintance, common interests, and other variables. When groups are formed in this manner, one of them usually attains a "ruling" position (Krech & Crutchfield, 1948; Sells, 1961; Mosca, 1939). The implication here is that the sub-group which attains the "ruling" position need not necessarily be the sub-group best qualified to control. In order for the shelter organization efforts to benefit from this natural sub-grouping tendency, it seems necessary (Parness, 1962; American National Red Cross, 1951; Goldbeck & Newman, 1960; Dunlap and Associates, 1960; Sells, 1961; Cohen, 1961; Baker & Rohrer, 1960; Guskin, 1958), to provide formally for sub-grouping within the population at hand, each sub-group having its own leader/representative. Because of the marked tendency for further spontaneous sub-grouping even within an established formal sub-group the problem becomes, finally, one of determining a group size which is maximally stable with respect to leadership, unity, and goal achievement.

Field observations have been made in an effort to determine the most frequent small group size in "three group categories: (1) informal, i.e., shopping, walking, (2) simulated informal, as acting in stage plays or movies, and (3) work, such as buying, repair, etc.," (James, 1951). A count of 7,405 informal, 176 simulated, and 1,548 work groups showed the average group in all categories to consist of about three persons with a maximum range (informal category) of two to seven. It should be noted, however, that at least the informal category represents free-forming groups and does not necessarily reflect optimal grouping should formal leadership be introduced. Ziller (1957), in a study concerned with the effect of group size on group decision making, observed 50 groups consisting of from two to six members. The experiment showed that, as size of the group increased from one to three, task performance became more accurate, while through four to five, the error percentage increased. When membership was increased to six, accuracy of performance again improved. The conclusions indicated that group size and accuracy of group decisions were positively related. Furthermore, groups of six recognized their need for organization,

hence produced more effectively than the smaller groups of four and five which did not, apparently, recognize the need to organize. Caplow (1957), also observes that organized small groups average about five to six members. Hare (1962), suggests that the development of leadership in groups of this sort is an alternative to the formation of smaller groups (sub-grouping), because the number of potential relationships between group members increases at a highly disproportionate rate to that of the increase in group size. (For example, there are 966 possible relationships between members in a group of seven, whereas for a group of four there are only 25.) This can account, at least in part, for the rather marked differences in group characteristics which can result from small increases in size (Beach & Lucas, 1960; Hare, 1962; Entwisle & Walton, 1961; Sells, 1961; Caplow, 1957; Berkowitz, 1958). In addition Bales and Borgatta (1955) have shown that there are significant differences between odd- and even-numbered groups. Even-sized groups show less cooperative activity and agreement than do odd-numbered groups. They suggest that this effect is the result of the possibility for division of the even groups into two equal but opposing sub-groups. Groups of odd sizes are less likely to demonstrate this sort of deadlock.

Research from various sources conducted on groups of different sizes and types (formal, informal, heterogeneous, homogeneous, etc.) has produced evidence concerning the type and direction of some of these size-correlated changes. A few of the more relevant are summarized below:

1. As size increases, leadership demands emerge. The institution of leadership in a group, in turn, leads to greater flexibility on size limits and allows the group to increase in size without complication (Hemphill, 1950; Sells, 1961).

2. As size increases, the quantity and quality of communication between members decreases and, thus, interpersonal orientation between members is affected (Hare, 1962).

3. As size increases, the probability of the emergence of subgroups increases (Hare 1962; Entwisle & Walton, 1961).

4. Participation rate per member in group activities decreases with increases in group size, with most members contributing less than their "equal" share to group activities (Bales, et al, 1951).

5. A smaller group, whether it develops organization or not, is more likely to succeed in achieving goals within its capabilities than a larger group.

6. As size increases, the likelihood of reaching group consensus decreases (Hare, 1952).

7. Intimacy and affectional ties between group members decreases as the group size increases (Hare, 1962).

8. As the size of the group increases, more delegation of authority is necessary. Members of larger groups tend to form sub-groups, with spokesmen for their opinion (Hare, 1962; Homans, 1950).

9. Organizational stability increases as the group increases in size (Caplow, 1957).

In addition to size itself, other important variables contribute to the character of the group, including such descriptive terms as: formal, informal, heterogeneous, homogeneous, task oriented, etc. For example, Jennings, as cited in Kelly & Thibaut (1954), has distinguished between "socio-group" in which the relations among members exist primarily with respect to working together on some common objective problem, and "psyche-groups" in which intermember associations constitute, in and of themselves, the major object of membership and the central purpose of the group. She points out that groups do not fall neatly into one or the other of these two categories but that, for example, every psyche-group must reflect some concern with external problems. [redacted]ems generally agreed that even in a group that is mainly oriented toward its environment, strong affective relationships develop among the members which must be taken into account in analyzing the group's total functioning. This view is stated in detail by Homans (1950).

Rohrer (1959), has observed structural differences between the groups of "large" and "small" polar exploration sites. In the small stations (numbering from 12 to 40 people), the personnel tend to develop "family-like" set of inter-relationships. In these small stations they come face-to-face with all other members of the camp innumerable times throughout the day. Moreover, because of the smallness of the group and the lack of "replacement" or substitute personnel to perform the various essential chores that have to carried out, there is a greater felt interdependence among the complement. Talacchi (1960), and Hilmar in (Baker & Rohrer, 1960). also point out the importance of interpersonal ties to satisfactory group function.

Another factor which relates strongly to grouping sizes is the geographic background of the group members. It has been observed (Hollingshead, 1949), that cliques formed by rural youth are generally of smaller membership (about three persons) than those of urban youth, which are likely to consist of four to five persons. It has also been observed at isolation radar sites that persons of rural background adjust to the corditions more quickly and to a greater degree than persons of urban background (Baker & Rohrer, 1960).

Adjustment is also affected by the religious, ethnic, and racial composition of the group. It is suggested (Sells, 1961; Baker & Rohrer, 1960), that similar backgrounds, experience and, more fundamentally, a common system of values are important factors in establishing and maintaining group unity. It is important to note, however, that in groups under conditions of common stress (Fritz, Raynor, & Guskin, 1958), group members show little or no inclination toward maintaining pre-existing prejudices but tend to function cooperatively and with a display of genuine camaraderie.

Also of importance, especially as reflected in individual attitudes toward the total group, is the skilled versus unskilled dichotomy. In a comprehensive study on the individual and organization, Argyris (1957) observed sharp differences in attitudes concerning the organization, job satisfaction and interest, perception of job reward, and general personality traits between skilled and unskilled workers. Skilled workers tend to have the desire for high quality workmanship, require challenge, creativity, and a sense of involvement and interest in their jobs, and place less emphasis on money as a reward for their services. Unskilled workers, generally, are the converse of the above group, with traits allied to the infantile personality. Their basic reason for working is remuneration with self-fulfillment not a factor. The group as a whole has a higher level of spoiled work and a lower rate of production.

The particular task or activity in which the group is engaged seems to have direct limits on the size of group which can cooperatively and efficiently accomplish the group objectives. For instance, Moede (1927), observed that a four-man team was most efficient for a task which required physical pulling power. He also noted that efficiency was reduced consistently with each increment in group size above four. The same inverse relation between individual production and group size has been observed elsewhere (Merriot, 1949), where physical production is involved. Taylor and Faust, (1952) observed that on a concept formation task, groups of two were superior in performance to individual efforts. Groups of four failed less often on the task; however, with increases in size, longer time was required for solution. This increase would be expected on the basis of the greater opportunity for interaction during the task performance. It is noted, however, that if time is introduced as a measure of effectiveness, the decrease in efficiency with the increase in group size becomes an important consideration.

Several studies have reported more effective problem solving by groups as compared with individual performance (South, 1927; Shaw, 1932; Dashiell, 1935; Ziller, 1957). South (1927), clearly demonstrates differences in effective group sizes for specific kinds of tasks. For groups of six, group decision took longer than for groups of three. Where the task requires a more technical and specific solution, however, the groups of six were faster. It is suggested that where the task has specific criteria, a larger group

is more likely to contain an individual who is capable of arriving at an answer acceptable to the other members of the group.[1] It should be observed in all cases that "the goal sought by the group. . .acts as a catalyst in reaching a decision, for if individuals derive personal benefit from the end product or voluntarily seek it, they are more apt to put forth their best efforts." (Kelly & Thibaut, 1954)

In relation to other group dimension variables, the group-leadership interaction stands as one of the most important. Not only does the mere fact of leadership have consequences for group dynamics, but the quality of this leadership can have important implications for effective group size and function. A good leader is better able to maintain his leadership in larger groups than is the poor leader. The number of individuals with whom the leader deals directly constitutes the leader's "span of control."

Entwisle and Walton (1961), sent questionnaires to executives of business companies ranging in size from 100 to 1000 employees and 20 colleges and universities of various sizes. On the basis of their observations plus information from Dale (1952), the authors suggest a slight but genuine positive correlation between the size of the organization and the size of the span for both companies and colleges. "Sheer size, then, rather than functional orientation may be the predominant factor in determining size of span. In summary, the results suggest that spans are not constant, but increase slowly as the size of the organization increases. The type of organization does not appear to affect the size of span, although admittedly data on this point are limited." The small but positive relationship between span of control and organization has some interesting implications in that the spans increase slowly (five to eight) while the "size of the organization increases more than twenty-five fold." This observation suggests that, though flexible within a specific range, the optimum span of control is fairly constant, falling in a limited range with a midpoint of seven.

The work of Havron and McGrath, as reported in Petrullo and Bass (1961), provides the most direct evidence concerning optimal basic grouping. In an experiment with Army subjects, they "trained and tested a number of squads in each of several sizes (four-, five-, six-, seven-, eight-, and eleven-man units) with a single unassisted leader." Eight units of each type were tested under a variety of tactical conditions for periods in excess of six hours. Data analysis revealed that, as group size increased, the leaders "were maintaining unit effectiveness at a greater cost--a higher activity

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[1] Task oriented information and references taken heavily from A. P. Hare (1962), pp 233-235.

level, more leader exposure to enemy fire, and so on." The squads of eleven were quite ineffective because of the extreme difficulty in coordinating and controlling this number of men. Intensive analysis of the remaining range (four to eight-man units) indicate that the groups of one leader and five men performed more effectively in this particular situation. Again the "span of control" falls within the range which would be predicted on the basis of aforementioned studies. Because the Havron and McGrath data were obtained under varied leadership-group size conditions and evaluated in terms of both leader and group effectiveness, their study may be considered especially relevant to the problem of manageable groups.

Implications of Existing Research for Shelter Grouping

In order to be directly applicable to the problem of manageable group size in a community shelter, research on groups must meet three basic conditions:

1. The groups investigated must be large enough in size to resemble the population units that will be found in a community shelter.

2. The groups studied must be similar in their functions and membership composition to those of shelter groups.

3. Groups must be studied in an environmental and social setting (involving stress and deprivation) that simulate the conditions under which fallout shelters will most likely be occupied.

In addition there is a fourth condition that is highly desirable, if not absolutely necessary. It is that groups be studied systematically by controlling or manipulating size, structure, or other variables relevant to shelter grouping.

There is no generally available, published research that satisfies all conditions. The body of research that comes closest to meeting the applicability requirements are habitability studies. Being simulated shelter stays, habitability studies fulfill one half of the second condition (group functions) completely. The NRDL studies (Strope, et al, 1960, 1961, 1962), each with around 100 subjects, satisfy the condition of group size to some extent. The third function of a realistic environmental social setting, is only partially met in the extended habitability stays. Although a two-week period of confinement in a simulated shelter does generate observable and occasionally explosive stress situations, these cannot be assumed to be comparable to human reactions under actual disaster conditions.

The major problem in interpreting and applying habitability data stems from the fact that group size and structure have as yet not been introduced as experimental variables in a habitability study. The closest such studies have come to manipulating grouping variables are in the A·I·R·-study, where the effects of a trained leader was systematically investigated, and in the NRDL studies (Strope, et al., 1960, 1961, 1962) where the comparative impact of an active versus a relatively passive leader was informally considered.

Because no habitability study has empirically investigated grouping dimensions, evaluation of comparative group sizes and structures must depend upon a comparison of two or more studies. The many important differences between habitability studies make generalizing about the relative effectiveness of group sizes and structures a speculative enterprise.

Despite their shortcomings, experiments similar to the habitability studies, which focus upon the size, structure and composition of groups, and upon methods of assignment and leader selection, appear to be the method of choice for empirically verifying the grouping recommendations presented in this report.

Another body of research that has implications for shelter grouping is composed of studies of military organization and operations. Theoretically, the community shelter bears resemblance to a large military unit under combat conditions. The shelter, like the military organization, is designed to function in wartime under conditions of stress. Both require hierarchical structures, rapid communication, and rapid decision-making. Both must be prepared to be totally self-sufficient for extended periods of time. Finally, both must operate under a set of rules that are frequently different from, and at odds with, peacetime customs and laws. This resemblance is acknowledged in the similarity between the sample shelter organizations, presented in Chapter VII, and the organizational structure of a large military unit.

Unfortunately, most of the empirical military group research has been conducted with small-sized groups--squads, and aircrews, which limits the generalizability of findings to the shelter situation. The differences in their membership composition and their functions constitute obvious and important distinctions between the military and the shelter systems. Membership in the former is made up of a selective population of males, highly trained to do a job under stress conditions, and trained to obey orders. This training is backed-up by the traditions and customs of the service, and the Uniform Code of Military Justice. In these respects, there is no comparability to the shelter population.

The goal of the military system is the accomplishment of its assigned mission, at whatever cost to its members that must be incurred. The formal organization of military groups is a means to achieve the assigned goals. The goal of the shelter system is the survival of its group members, and shelter organization is a means to achieve this goal. The difference in goals is another reason why the shelter system cannot be conceived of in purely military terms.

Studies of natural disasters, of the social effects of bombing of civilians, and internment experiences are important sources of information for shelter management. Unlike habitability research with its volunteer subjects and military group research with its highly selective population, disaster studies describe the behavior of the types of people who will be in community shelters, under genuinely stressful conditions. As valuable as this information is for shelter management in general, it has contributed little of an empirical nature to the subject of population grouping. Disaster research, being of recent origins as a field of specialization, has tended to produce descriptive studies of unique events or situations. These studies generally attempt to present as wide a range of material as possible about an extremely complex social phenomenon. It is perhaps premature to expect detailed analyses of one facet of this phenomenon--grouping patterns and their implications. Even if students of disaster were interested in gaining empirical information about grouping in a disaster, such data would not be easy to obtain directly during the catastrophe, and equally difficult to reconstruct without distortion, after the event.

Finally, two types of research on "peacetime" groups must be mentioned. The first encompasses the wide range of experimental studies commonly labeled "small groups" research and academically identified with the discipline of social psychology. It should be noted that the literature review in the previous section of this chapter is largely concerned with small group studies. In terms of the fourth condition of applicability (systematic investigation of grouping dimensions) the literature of small groups surpasses any other body of research considered in this project. Almost all of the variables that are relevant to shelter grouping have been experimentally manipulated in at least several small groups studies. However, the applicability of the data to shelter grouping recommendations is limited, for a few reasons. The first and most obvious is the fact that the size of the group with which this research area is concerned corresponds to only one of the four levels of shelter groups described in this report. Secondly, unlike community groups in a shelter, most of the experimental groups are task-oriented. In this respect, the experimental groups are much more closely related to task teams in a shelter. Still another limitation is imposed by the usual membership composition of small groups. The subjects generally are students, and/or volunteers, with the result that experimental small groups are far from representative of the population to be found in community shelters.

The second type of "peacetime" group research comprises studies of organizations or of segments of organizations. Frequently, these are applied studies, carried out under industrial auspices, to improve the effectiveness of organizational performance. On the plus side, these studies often focus on larger groups than do the experimental studies, and they deal with grouping problems that are directly relevant to the shelter situation (for example, the problems of span of control, of communications up and down channels). But here too, the direct applicability of research findings is limited by the vast differences between: (1) the goals of business or industrial organizations and a fallout shelter, (2) the functions of both leaders and members in the two groups, and (3) the environmental and social psychological settings in which each organization operates.

Although the previous discussion has emphasized the scarcity of group research data that bears directly on the problem of manageable population units on a community shelter, it should be stressed that the survey of the literature was of great value in the course of the project. The shelter system analysis was based in large part on the available literature, in conjunction with field trips. Most of the grouping principles in the following chapter were derived from the literature, either directly, or more frequently, by implication.

V. GROUPING PRINCIPLES

Description of Grouping Principles

The results of the evaluation of the technical literature and the analysis of the shelter system are reflected in two different levels of statements about groups: (1) grouping principles and (2) grouping recommendations. Recommendations, found in the next chapter, are detailed statements about such variables as group size and structure that comprise our suggested solutions to the problem of organizing a shelter into manageable units. Recommendations are one of the outputs of the application phase of the research. Specific recommendations, however, cannot be derived directly from the research findings. Between the findings and the recommendations there must be a mediating conceptual level that serves to abstract and unify the findings and provide a basis for generating and evaluating specific recommendations. Such are the functions of the grouping principles. The derivation of grouping principles is the culmination of the analysis phase of this study. Principles are theoretical statements pertaining to the observed or hypothesized nature of grouping dimensions, and the relationships between the dimensions and the shelter variables.

The grouping principles may be viewed as the first step towards a special theory of the determinants of group size and structure. "Special theory" refers to the fact that its applicability to groups other than community fallout shelters has not been formally investigated. Informally, however, there appear to be significant analytic distinctions between community groups in a shelter and other hierarchical social organizations.

The following pages contain three types of grouping principles. These may be referred to as "will," "can," and "should" statements. A "will" principle is one that states a direct cause and effect relationship between a shelter variable and a grouping dimension. For example, "if variable X increases, dimension Y will decrease." A "should" principle is a generalized statement to the effect that when shelter variable X occurs (other things being equal), the Shelter Manager or planner should do Y. The distinction between a "should" principle and a grouping recommendation, is that the former is a solution on the most general level that can be meaningfully discussed, while the latter represents the most detailed solution which seems feasible to suggest. Between the "should" and the "will" statements are the "can" principles. These are statements of conditional relationships, in the form of, "if shelter variable X increases, grouping dimension Y can increase" (that is, has the capability to increase, if the shelter management determines that it is desirable). The rather primitive state of a general theory of human groups in the behavioral sciences is indicated by the paucity of "will"-type statements among the grouping principles.

Some Methodological Comments on Grouping Principles

1. The Grouping Principles chapter is organized in the following manner. Prefacing the presentation of grouping principles is a description of shelter variables and grouping dimensions. These are the two primary tools of the analysis. Grouping principles are discussed in terms of shelter variables that affect grouping dimensions. Following the prefatory material, the principles that apply to each grouping dimension are presented. Each principle receives a brief discussion. Following this discussion are listings of "modifiers" which are shelter system variables that create a tendency towards change in one or more aspects of a group. For example, if the size of the shelter (a shelter variable) has an effect upon the number of grouping levels (a grouping dimension), the effect is cited and discussed.

2. Not all relationships between shelter variables and grouping dimensions are discussed within the grouping principles. They are only evaluated in those cases where a variable is deemed to be important or illuminating for grouping.

3. This report recommends a hierarchical structure for grouping in community fallout shelters. The structure closely resembles that of the traditional bureaucratic model, as exemplified by the military or the large business organization. However, shelter grouping is not guided by such goals as rationality, efficiency, or division by specialization nearly so much as a business organization. The structure of hierarchical community groups in a fallout shelter represents a different type of bureaucracy, and the rationales that support these grouping principles are based on this special type. The reader who is versed in the literature on social organization may note some uncommon reasons listed to support the grouping principles. It should be kept in mind that the rationales are the result of our analysis of the organization for group fallout shelters, which often are not applicable to standard bureaucratic models. The reverse is also true; explanations of "normal" bureaucratic structure and process often do not apply to the community fallout shelter.

4. It should be kept in mind that the phrase "other things being equal" is implicit in all statements of the principles. In the sections on recommendations and applications, the implications of "all things not being equal" are considered.

5. The principles pertain to a shelter that is operated on a single-shift basis; the implications for sub-grouping of two and three shift shelters have not been considered in this report.

Shelter Variables

Shelter variables are features of the shelter system that have a significant effect upon the size, structure, or other dimensions of shelter grouping. The analysis of the shelter system has revealed the following variables to have important influences upon community groups:

- Shelter size,
- Shelter configuration,
- Shelter facilities,
- Population characteristics,
- Pre-trained management,
- Pre-organized shelterees,
- Pre-knowledge of other shelterees.

Shelter Size

The variable with an overriding effect upon shelter grouping is shelter size, that is, the number of people in a given shelter.

Shelter Configuration

Shelter configuration means the physical layout of the shelter. The shelter can consist of a single space or multiple areas; the multiple areas may be contiguous or physically separated.

Level of Shelter Facilities

The shelter that has an extremely low level of survival supplies and equipment faces a set of management problems that may call for a different mode of community grouping than the shelter that has a less austere level of facilities. The level of supplies may be affected by several possibilities. The original stocks may be at a minimal level. Overcrowding or an extended shelter stay may also deplete shelter supplies.

Population Characteristics

The distribution of the population as to age, sex, social class, and ethnic backgrcund has an impact on shelter grouping. A shelter with a heterogeneous mixture of these characteristics is a different shelter from the point of view of manageable group size and structure, than a shelter with a homogeneous population. Similarly, a shelter with many children may require different grouping patterns than an all-adult shelter.

Pre-Trained Management

The extent to which a pre-trained, and perhaps, pre-organized management staff is available in a shelter will be an important consideration in establishing shelter groups.

Pre-Organized Shelterees

The degree to which the shelterees are part of a common pre-shelter organization (an office or plant, school, perhaps even a neighborhood) will have implications for community grouping in-shelter.

Pre-Knowledge of Other Shelterees

A shelter in which a large part of the population are acquaintances, friends, relatives, or perhaps just know of each other, will tend to have a different grouping pattern than the shelter in which strangers are the rule and friends the exception.

Grouping Dimensions

Grouping dimensions are aspects of groups that are central to the problem of organizing a community fallout shelter into manageable units. The following are the grouping dimensions upon which grouping principles and recommendations have been based:

- Formal grouping,
- Group size,
- Group structure,
- Group responsibilities,
- Timing of group formation,
- Selection of leaders,
- Assignment of shelterees to groups,
- Shelteree mobility.

Formal Grouping

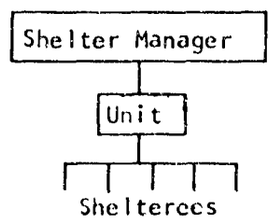
Although formal grouping is actually not a grouping dimension, it is a basic assumption which underlies everything that follows. The principles and recommendations presented in this study are based on the assumption that formal grouping of the shelter population is a necessity. The rationale for the necessity of shelter grouping is presented under this heading.

Group Size

Group size is concerned with the number of people that each type of community group should optimally contain to carry out its function as effectively as possible. The dimensions of group size and group structure are closely related.

Group Structure

The term "group structure" is used in this report to refer to the number of hierarchical management levels that are necessary for effective command/control of a community shelter. The term, generally, has a broader meaning when used in the social sciences. The following is an illustration of a group structure with two management levels:



The principles and recommendations under this dimension revolve around the problem of whether and when to change the number of management levels versus changing the number and size of groups, while keeping levels constant. The problem may be stated as, when to change the group structure vertically (change levels) and when horizontally (change group size and number only).

Group Responsibilities

This dimension pertains to the responsibilities of the leaders of the various community groups. Two types of responsibilities are considered; operational and management. The key issue in this dimension is the determination of which leaders will have the responsibilities for shelteree performance and behavior within community groups.

Timing of Group Formation

This refers to two aspects of shelter grouping. The first is the time when grouping should take place during the shelter stay. The second, and more problematical, is the order in which different shelter groups should be organized.

Leader Selection

This dimension deals with whether leaders of different levels of shelter groups should be selected by shelter management, or elected by shelterees. If leaders are to be selected, the basis of this selection must also be determined.

Shelteree Assignment

This dimension pertains to the methods and the underlying rationales for assigning shelterees to different types of shelter groups.

Shelteree Mobility

Mobility refers to movement within and between groups. This section describes the extent to which, and the conditions under which, shelterees may change their in-shelter group affiliations during the course of the shelter stay.

The Principles of Formal Grouping

General Principles

In all shelters, regardless of size or condition, the population should be divided into groups on some formal basis Formal grouping refers to the establishment of community units of varying sizes, with designated leaders, a general set of responsibilities, a definite location in the shelter, and procedures for the assignment of group members. Formal grouping also refers to the development of patterned relationships between shelter groups.

Discussion

The three major functions of community groups in a shelter are: (1) the psychological, (2) the operational, and (3) the management functions. Although they are not mutually exclusive, it is meaningful for study purposes to consider them separately.

The psychological function of community groups is a shorthand term that covers the gamut of gratifications that individuals receive from group membership. This includes feelings of being liked, of belonging, of giving and receiving solace and comfort, and of becoming personally motivated to achieve the goals of the group.

There are instances in human history where groups have perished, not directly from physical or environmental causes such as starvation or torture, but because group ties between individuals could not be sustained. Instead of a united group motivated to achieve common ends, there emerged an aggregate of unattached persons, striving to achieve individual purposes. Consequently, activities were carried out at cross purposes without common direction, and resources were squandered until ultimately many people perished. Such a situation could also occur in a shelter in the absence of firm leadership and strong group ties.

The second function of community groups may be called the operational one. It pertains to the organization of group members to fulfill the activities of the group. Although all shelters will have a set of task teams responsible for performing the more technical tasks, the shelterees will be directly involved in numerous task areas including: food and water, sleep, sanitation, medical care, training, recreation, and certain protective and emergency actions. Under the most ideal conditions, these tasks would be veritably impossible to implement effectively in a non-organized fashion. In a shelter, the only conceivable approach to group activities is through organization of the population into formal, manageable units.

The third function of community groups has been t.tled the management function. Any group as large and as complex as even the smallest community fallout shelter must extensively plan, coordinate, and closely control the use of its resources, including its human resources. Grouping shelterees into formal population units is a prerequisite for such planning and control.

Modifiers

1. Size of shelter: The larger the shelter population, the greater will be the need for formal grouping, especially to conduct the operational and management functions of community groups. Neither group activities, nor over-all planning and coordination, can be carried out in the absence of organization. Individual shelteree needs could frequently be met through informal, spontaneous grouping or on the basis of pre-shelter friendship or kinship. However, even in these cases, formal grouping makes a contribution towards satisfying shelteree emotional needs by indicating that leadership is undertaking positive and visible actions to increase survival chances. This may be an important factor in maintaining or re-establishing shelteree morale and motivation.

2. Shelter configuration: The existence of separate areas in shelter has a significant influence upon shelter grouping. Separate areas provide a natural basis for grouping shelterees into manageable and psychologically meaningful units. The visible barriers created by physically separate shelter areas enhance group feeling among shelterees, by clearly identifying group members and distinguishing them from non-group members.

From a management control point of view, separate areas can have both positive and negative consequences. If there are too many physically separated areas, the problems of over-all coordination and supervision are increased; however, within each bounded area, management control becomes easier to achieve.

3. Facilities: The lower the level of survival supplies and equipment, the greater will be the need for formal grouping in a shelter.

Formal subdivision of the population increases management control over the distribution and use of the supplies that are available. Also, formal grouping means that shelteree behavior can be monitored more closely to prevent and control disorder that may result if shelterees attempt to maximize their individual survival chances. Where supplies are low, survival will depend, in large measure, upon the motivation and morale of the population. To the extent that formal grouping can match shelterees with similar interests and background, thereby tending to increase positive group feeling, and to the extent to which it demonstrates that management is doing something for survival, formal grouping serves the psychological function of community groups.

4. Population characteristics: The greater the homogeneity of the population, the easier it will be to organize the shelter into manageable units.

Everything else being equal, it will be more difficult and take a longer period of time to establish positive group feelings in small groups composed of people of dissimilar ages and social backgrounds.

From the operational and management points of view, similarity in shelteree background will ease the problem of organizing formal groups somewhat. The closer the backgrounds of shelter members are to each other, the greater the chance of developing a single set of shelter regulations and procedures that will be accepted and adhered to by everyone in the shelter.

Under certain conditions, homogeneous population characteristics may lead to a problem for management. In many shelters, the majority of the population may consist of members of two or three religious, ethnic, social classes, or have other pre-shelter group affiliations. The members of any such group will tend to stay together in the shelter. While their homogeneity will increase cohesiveness within their group, it may also result in increased antagonism between their tightly knit shelter group and the equally cohesive groups composed of members of other religions, social classes, ethnic groups, etc. This situation may lead to one group seeking additional privileges and advantages in shelter. The problem for the shelter manager is to see to it that the strong, positive feelings that will tend to develop within groups of homogeneous background, do not result in inter-group squabbles and antagonisms.

5. Pre-trained management: The greater the number of pre-trained management personnel, the more effective shelter grouping will be in satisfying emotional needs, carrying out activities, and maintaining over-all control.

6. Pre-organization of shelterees: If many of the shelterees belong to one or several pre-existing organizations, the pre-shelter organization should become the framework for shelter grouping, wherever possible and to the degree possible. Even if many of the members of a pre-existing organization do not know each other personally, they will tend to know the leaders, and to be acquainted with the various groups of the organization. In any case, pre-existing organization will make population grouping much easier in shelter.

7. Pre-knowledge among shelterees: Ties of friendship and kinship provide a framework for the division of the population. The greater the extent of pre-knowledge among shelterees, the more rapidly and effectively shelter grouping can be achieved and maintained for two reasons. The greater the extent of pre-knowledge, (1) the closer the emotional bonds between shelterees, and (2) the greater the probability that operational and management rules and procedures will be followed by the population due to informal pressures, generated within the group. It should be noted, however, that under certain conditions, this phenomenon can thwart management. If group members perceive shelter leaders as being remiss in their duties, a high degree of pre-knowledge among shelterees can intensify and unify opposition to the leaders and create a potential social control problem.

The Principles of Group Size

General Principles

The principle of group size may be summarized as "size follows function." Each of the three major functions of community groups, psychological, operational, and management, is broadly identified with a group of a certain size.

The emotional needs of shelterees are best satisfied by a small group, within which intensive, face-to-face interaction can take place in a relatively enduring relationship. In the shelter, this group will be called the Unit.

The "operational group" is a medium-sized group called the Section. The leader of this group has direct responsibility for and control over the group members engaged in a community group activity. Consequently, the optimum size of the group that undertakes activities as a unit is determined by the leader's span of control.

For management control, a large community group, called a Division, is desirable. As a rule, management control is best achieved with few separate groups. Planning, coordination, and over-all direction are more effective when the number of groups with which management functions are directly concerned is small.

Discussion

The Unit is the shelter version of what sociologists refer to as the primary group. The primary group is characterized by small size and intimate, face-to-face interaction. In shelter, it will be the group of family, friends, or "neighbors," who will minister to the individual's emotional needs and among whom he will be recognized as a person, rather than only a face or a number. In order to carry out its functions, the primary group has to be relatively small. The range of the Unit has been suggested as seven to twelve persons. Seven is the lower limit because it appears in the social psychological literature as the smallest group size for which leadership becomes obvious and necessary. Twelve is the "normal" upper limit. Above this number, the leader may have difficulty in providing all members of his group with equal opportunities for intensive interaction, which is the "raison d'etre" for the primary group.

The Section is generally the basic community group in shelter. Like the Unit, the Section serves the emotional needs of the shelterees by offering group identity and a sense of belonging at a less intense emotional level than the Unit. In addition to its morale function, the Section also occupies a key position in the social structure of the shelter. Its members participate

in a majority of shelter activities as a group, including: sleeping, eating, training, and education. It is the group within which informal methods for social control can develop and operate, and it is a quasi-political unit, with a leader who represents it to higher management. Thus, it participates in making democratic decisions about shelter procedures.

The limits upon the size of the Section are fixed largely by the duties of the Section leader. He is directly responsible for the performance and well-being of his group. He must, therefore, know them all, though not as intimately as the Unit leader, and he must be able to observe the behavior of all Section members. Data from two-week habitability studies indicate that a leader can meet the above requirements with a group of 30. The upper limit of the size of the Section has, as yet, not been empirically determined. Several studies of extended shelter occupancy have indicated that a trained Shelter Manager can be directly responsible for as many as 100 persons. However, these studies were carried out with highly selective populations, which, because of their status, were prone to follow the directions of a recognized leader. Another characteristic of habitability studies that makes generalization of grouping recommendations quite speculative is that in all such studies a single, small group is enclosed in a single, small space with generally a single leader. In reality, a majority of the population will be in shelters in which Sections will be embedded in Divisions, and Divisions will be part of Departments. The entire question of the effects of organizational size and complexity upon the group leaders' span of immediate responsibility has yet to be studied in a fashion applicable to community fallout shelters. The unresolved issue of the upper size limit of the Section may be illustrated by a final point. It may be argued that within a confined space, represented by a small shelter, it is possible for one leader to supervise a larger number of people because they are in close proximity to each other and to the leader. This would be true if close proximity did not have additional consequences that may affect span of responsibility in an adverse manner. The results of "close-in" living, under disaster conditions in terms of tensions and hostilities, in terms of all the possible things that people can accidentally or intentionally do to each other in a shelter, will require that the group leader be perpetually on the alert. The leader can theoretically control more people in a confined situation, but equally theoretically, there may be much more to control, as a result of confinement. Neither the theory nor the data are available to provide a definite answer to the problem raised above. It is our interpretation of the theoretical and empirical clues that are to be found, that 60 represents a realistic and practical upper limit of people for whom a single shelter leader can be immediately responsible.

Although shelterees may commonly identify in some ways with their Division, this level of shelter grouping is essentially for management control rather than for shelteree morale. It would be extremely difficult for a Shelter Manager to coordinate the activities of 1000 shelterees, organized into twenty Sections. However, by establishing four groups of 250 people each, and delegating management authority to the leaders, the shelter becomes more effectively organized. The Division leader's function is to plan and oversee the activities of his group in coordination with top shelter management.

The Division leader interacts with the individual shelteree only as the latter becomes a problem that the Section leader cannot handle.

The size of management control groups are defined less distinctly by theoretical considerations than the smaller shelter groups. One can only say that if groups are too small, planning and control will be made more complicated. On the other hand, if they are extremely large, more subdivisions within the group will be required, with negative results.

The Department is essentially similar to the Division. It is a large-size administrative group for management control and will be found only in very large shelters.

Modifiers

1. Size of shelter: From the standpoint of the emotional needs of the shelteree, the size of the shelter group should remain small or become even smaller, as the size of the shelter increases. Because in a small shelter, people can identify with the entire shelter as a group, the size of the Unit is not too critical, within limits. However, in large shelters, the ability to identify meaningfully with all shelterees is lost, and emotional gratification must come from shelter sub-groups. The smaller the group, the greater can be the emotional involvement.

From an operational point of view, the greater the number of people in shelter, the larger should be the size of the operational groups. This relationship will also hold true for management control groups. However, the upper limit is more critical for the Section, which is a medium-sized group, than for Divisions and Departments.

2. Shelter configuration: For all sized community groups, the availability of separate areas should be considered in sub-grouping the population. Where possible, the size of shelter groups should conform to the number and capacity of separate shelter areas.

3. Facilities: As the level of survival supplies and equipment decreases, the groups which meet psychological and management control needs should be made smaller. Minimal facilities mean increased management problems in keeping people alive and under control. Decreased sized groups in a shelter with minimal stocks will tend to increase management control over shelterees to prevent disorder, and increase control over resources to insure that they last as long as possible. Smaller group size will work in the direction of increasing group cohesiveness, which will be a key to shelter survival in the absence, or limited availability, of supplies.

4. Population characteristics: As the homogeneity of the population increases, the capability of extending the sizes of shelter groups is increased. People with similar characteristics will tend to establish more intensive interaction patterns earlier, and will also tend to behave in similar, more predictable ways. This means that a group leader will be able

to supervise a larger group of homogeneous shelterees with little, if any, loss of effectiveness.

5. Pre-trained management: The greater the number of trained management personnel in shelter, the larger the size that all shelter groups can be without loss of control. We must operate on the assumption that a trained man has a span of control that is larger than that of an untrained person, and can satisfy shelteree needs more effectively.

However, if there is a surfeit of management personnel (a more likelihood), the size of shelter groups may have to be decreased in order to utilize the skills of all trained people.

6. Pre-knowledge of other shelterees: The extent to which the shelter population is friendly or acquainted with each other has an implication for group size. The greater the extent of pre-knowledge among shelterees, the greater the capability of increasing the size of all levels of shelter groups.

The rationale is similar to that for population homogeneity.

The Principles of Group Structure

General Principles

The organization of community groups in all shelters should take the form of a hierarchical structure. At least one management level should intervene between the Shelter Manager and the individual shelteree. The central issue concerns the optimal shape of this structure, whether it should have few management levels and many groups on one level, or more levels with few groups on a level. Management control generally is enhanced by a structure tending towards the vertical; that is, with a number of grouping levels. Operational control is most efficient when there are few levels between the leader responsible for an activity and the people carrying it out. Whichever structure is used, the number of management levels should be kept as few in number as is compatible with effective command/control of a given shelter.

Discussion

It will be exceedingly difficult for a single leader to effectively supervise more than 60 or so people in any community shelter, or in any group within a shelter. An intervening leadership level or levels will keep the top leadership level from being overburdened by interactions with and responsibility for individual shelterees, and allow them to concentrate upon the over-all direction of the shelter or the group.

What shape the hierarchical organization should take is a question of span of control versus chain of command. By keeping the number of management levels low, the leader shortens his chain of command. There are fewer intervening levels between himself and the shelter population; information tends to reach the leader more rapidly and with less distortion; the capability for rapid decision-making is increased. But these advantages are not gained without penalties. The group leader must now supervise a larger number of sub-group leaders. Although he gets more information more rapidly, much of this information may be superfluous because there are no intervening management levels serving to filter out non-essential communications.

By adding intervening management levels, the number of people whom the leader must directly supervise is decreased, but the leader's chain of command is extended and he becomes further removed from the shelterees.

Modifiers

1. <u>Size of shelter</u>: The relationship between size of shelter and group structure most directly concerns the management functions of community

grouping. The greater the number of people in a shelter, the larger the number of management levels necessary for effective command/control.

A shelter of 100 can be efficiently organized with two management levels (the Shelter Manager plus one level of group leaders). A shelter of 500 requires three management levels. A 500 person shelter organized with only two management levels can either have a few large groups or many small groups on one grouping level. Either choice has potentially serious consequences. The alternative of few large groups results in a shortened span of control for the Manager, but compounds the problems of sub-group leaders by giving them direct responsibility for many more shelterees. On the other hand, many small groups ease the problem for the sub-group leaders, but tend to stretch the Manager's span of control beyond the maximum for effective command. The clear-cut solution is the introduction of a third management level.

2. Shelter configuration: The physical layout of the shelter may have an influence upon the grouping structure. The greater the number of non-contiguous areas in a shelter, the more difficult it will be to maintain an effective hierarchically-structured organization.

This principle does not imply that a hierarchical structure will be less desirable, or not as necessary, only that it will be more difficult to maintain. Physically separated areas in shelter tend to lengthen both span of control and chain of command, in a purely geographical sense. Capabilities for both communication and direct supervision are diminished in the presence of physical barriers between groups. This is probably true even if phone or other media link the sub-group leaders to the Manager. The general tendency will be for physically separated groups in shelter to become relatively more independent entities.

3. Shelter facilities: As the level of shelter supplies decreases, the number of grouping levels should increase. Increasing the number of management levels serves the same purpose as decreasing the size of shelter groups. It results in tighter supervision over the individual shelteree's use of resources.

4. Pre-trained management: The number of trained or experienced management personnel available in a shelter is a factor to consider in determining community group structure. The fewer the number of trained or experienced personnel, the fewer the number of management levels desirable.

If there are no trained people with the exception of a trained Shelter Manager, the principles of community grouping would call for few management levels, and many groups on one level. The goal is to limit the number of people for whom inexperienced group leaders will be responsible, and to permit closer contact between the Shelter Manager and the untrained leaders. This places a burden upon the Shelter Manager, but the assumption is, that as a trained manager, he will be able to supervise more sub-group leaders.

If there are trained or experienced people among the shelter occupants, then more grouping levels can be added to ease the Manager's control problem by decreasing the number of leaders whom he directly supervises.

5. Group levels and pre-organized shelterees: In cases where the entire shelter population or the largest part of it are members of a single organization, an effective group structure may be achieved by utilizing that organization's structure as the basis for shelter grouping. In such cases, the number of shelter management levels would correspond to the number of levels in the existing organization.

A Shelter Manager should take advantage of any "headstart" he can get in organizing his facility. Although shelter grouping begins upon entry, or shortly thereafter, it may take a considerable length of time before the new shelter organization is fully accepted by shelterees. If the Manager can utilize the pre-existing group structure, the acceptance time may be cut down considerably.

6. Pre-knowledge of other shelterees: The greater the extent of pre-knowledge among shelterees, the fewer the management levels that are necessary. This is even more the case if shelterees know and are known by management. The principle of group size holds that as the extent of pre-knowledge increases, the size of shelter groups can increase without impairing manageability (p.40). An "increased group size capability" is essentially another way of saying a "nee for fewer management levels." The rationale is identical.

The Principles of Group Responsibilities

General Principles

The principle of group responsibilities largely pertains to the operational and management functions of shelter grouping. In general, community group activities are most effectively carried out when operational responsibility is vested in the medium-sized groups. The management function, on the other hand, is best served by assigning coordination and control responsibilities to larger groups. The small group or unit may be considered the center for responsibilities dealing with emotional needs of shelterees.

Discussion

If operational responsibilities are too centralized; that is, if they are placed in very large groups, it becomes difficult to control the performance of particular tasks or to supervise specific activities. Also, if groups are too large, the possibility of assigning tasks and activities on the basis of individual capabilities and desires is lessened or lost. Under the generally stressful conditions of shelter living, the more compatible shelterees find their tasks, the better their performance and emotional states will be. On the other hand, if operational responsibilities are too decentralized; that is, if they are located at too low a group level, great shelter-wide variability in the performance of tasks will result.

If the responsibilities for management supervision are placed at too low a grouping level, an overabundance of small grouping entities would have to attempt to carry out coordination and control functions. The all-but-certain result would be a lower level of effectiveness in the over-all direction of the shelter.

Modifiers

1. Size of shelter: The larger the shelter population, the higher will be the group level where operational and management responsibilities should be located. An increase in shelter size means an increase in the number of shelter groups, largely in the small- and medium-sized groups. This means more group leaders with operational responsibility for the performance of group activities, which, in turn, means greater variability in the implementation of activities. One solution is to elevate operational responsibility to a higher group level. While this tends to standardize the performance of activities, it affects operational responsibility negatively in that the leader of the large group cannot directly supervise the activity involving all of the members of the group. A resolution of this dilemma is

to share operational responsibility between the medium and large groups: the larger group nominally takes the center of responsibility, but the medium-sized sub-groups handle the direct operational supervision.

2. Shelter configuration: The size and number of separate areas in the shelter should influence the selection of a grouping level at which responsibilities are centered. If there are many areas, there should be a tendency to choose a lower level for centralization of activities and responsibilities. Since communication difficulties may result in less effective control, supervision of activities being carried out in different shelter areas should, therefore, rest with the leaders in those particular areas.

If there is a single space, or a few large spaces, responsibility should center at a higher level to avoid competition, noise, and confusion.

3. Shelter facilities: The poorer the shelter facilities, and/or the environmental prognosis, the higher will be the level which should control use of facilities. Activities not requiring the use of facilities should be centered at the medium level. This group, being more cohesive and better controlled than the higher level, becomes more important as conditions worsen.

4. Population characteristics: The greater the homogeneity of the population, the larger the groups to which operational responsibility can be assigned. The rationale is essentially the same as for population homogeneity, and group size (p.40). Because greater homogeneity tends to lead to greater group cohesiveness and more predictable behavior on the part of shelterees, the number of shelterees for whom a leader can be operationally responsible is increased.

5. Pre-trained management: The level at which group responsibilities centers should be one where trained or experienced leadership is available. If there is a large group of trained management, as in a pre-organized shelter, the level may be the medium-sized group. The fewer the trained management personnel available, the higher the level in which responsibility should be centered. Training is necessary, or at least very desirable, for the supervision of many of the activities in which shelterees will engage. If no trained management is available, more efficient utilization of facilities will be possible if fewer people make decisions affecting them.

6. Pre-knowledge of shelterees: The more people each shelteree knows, the higher the level at which activities and responsibilities can center. The rationale is the same as for population homogeneity and group responsibility (above).

The Principles of Timing of Group Formation

Two aspects of timing are contained within this grouping dimension. The first is when shelter grouping should begin, the second, which group should be organized first.

General Principles of Timing

The process of grouping should begin upon shelter entry or as soon as possible thereafter. When rapid organization is essential for initial operations and management, temporary grouping of shelterees should be conducted on the basis of "first come, first grouped." After the initial protective actions have been taken, the organization can be modified into permanent groups which can better support the psychological function of community groups. When an immediate, temporary grouping pattern is used, shelterees should be reminded that there will be opportunities to change groups (see Shelteree Mobility, pp.53-54 , and Assignment of Shelterees to Groups, pp.51-52).

Discussion

Early organization has several advantages for the shelter: (1) it allows the initial protective actions against weapons' effects to be executed rapidly, (2) it leads to more rapid control of shelteree behavior, at a time when many shelterees will be anxious, stunned, and confused, by showing them that something can and is being done for them.

General Principle of Priority

Each major function of the shelter suggests a different priority for the size of the group to which shelterees should be first assigned. From the operational standpoint, shelterees should be assigned initially to middle-sized groups which, in turn, should be combined into larger "management groups" and then subdivided into "psychological groups." Management criteria indicate that large groups should be organized initially, then subdivided, while the psychological function is best supported by initial assignment to small-to-medium groups.

Discussion

The positive impact of initial organization may be reduced if the group assignment is too large, or too small. If the group assignment is too large, shelterees will see themselves as part of a large, impersonal aggregate of

bewildered individuals. There will be little, if any, chance of contact between the group leader and shelterees. In addition, it will become more difficult to communicate and carry out the necessary immediate actions in shelter.

Modifiers of the Timing Principle

1. Size of shelter: The larger the population in shelter, the greater will be the necessity to begin immediate grouping.

In small shelters (50-200 people), it may be possible to begin operations before the population has been grouped. In larger shelters, grouping must begin prior to, or at least concurrently with, protective actions and other initial shelter operations. Since shelter management must depend upon uniform response by shelterees to management directives concerning protective actions, some form of established organization may increase the likelihood of achieving such a response.

2. Configuration of the shelter: The configuration of shelter areas has more effect on how successful initial grouping is likely to be than when grouping should begin. In other words, the greater the number of separate areas in shelter, the greater is the probability that a form of effective organization will be rapidly achieved. The effect of a physical boundary on management control and shelteree group feeling has already been mentioned in the relationship between configuration and group size (p.39). In this connection, it might only be added that group cohesiveness is an important factor in social control. The more shelterees identify with a group, the more likely they are to conform to the expectations of that group, expressed as orders from a formal leader or informal pressures from other group members. However, the effect of a physical boundary may rebound to management disadvantage if the separation from other groups is so complete and communication between groups sporadic that the group members feel isolated from the rest of the shelter, or that other shelter areas are better off. This may be particularly stressful during the early stages of the shelter stay, when the major part of the population will still be anxious and uninformed.

3. Population characteristics: The greater the homogeneity of the population, the greater the probability is that organization will be developed early and successfully. The more people have in common, the more readily positive feelings will evolve among them. The sooner positive group feelings evolve, the earlier the organization will become accepted by shelterees.

4. Pre-organized shelterees: If shelterees are all members of one or several existing organizations that will be used as a basis for shelter group structure, there is no timing problem.

5. Pre-trained management: The greater the number of trained management personnel, the sooner groups can be organized. In the absence of pre-trained group leaders, time must be spent in identifying and briefing acceptable leaders from the population at large. Where trained personnel are in shelter, they can immediately take charge of their groups.

6. Pre-knowledge of other shelterees: The greater the pre-knowledge of other shelterees, the greater will be the likelihood that shelter organization will be developed rapidly and successfully. The reason for this is identical to that of Population Characteristics, above.

Modifiers of the Priority Principle

1. Size of shelter: The larger the shelter, the larger will be the group to which individuals should be initially assigned. However, this group should not be larger than the Division. The reason for this modification is given in the discussion of the general principle of initial assignment (p. 36).

2. Configuration of the shelter: The shelter configuration should be considered when selecting the size of group for initial assignment. Whichever group is organized first should conform to the number and capacity of separate shelter areas, if they exist. If the first group to which shelterees have been assigned must be subdivided to fit into the configuration of the shelter, then the original benefit of assigning people to that group will have been diminished.

3. Pre-trained management: The first group to which shelterees are assigned should be led by a trained leader. Consequently, the fewer the trained management personnel, the larger should be the group to which shelterees should be assigned. The purpose for selecting this specific group level is to maximize the capability to communicate and implement immediate survival activities. This purpose will most likely be accomplished if shelterees are assigned to a group headed by trained management personnel.

4. Pre-knowledge of other shelterees: The greater the pre-knowledge among shelterees, the larger will be the group level that can be initially organized. If many of the shelterees know each other prior to shelter entry, the problem of individuals being "lost" in a group of huge dimensions is minimized. Because group feeling is already partially achieved through pre-knowledge, the resulting group can be larger than if it were composed of strangers.

The Principles of Leader Selection

General Principles

Each of the three functions of community groups depends upon somewhat different leadership characteristics.

From the psychological standpoint, the leader should be known and liked by the members of the group, and he, in turn, should understand them. Ideally, he should have a background similar to that predominant among group members. Specific training and experience, while frequently of value, is usually secondary to personal and background characteristics. Therefore, the leader of the unit should be elected by its members.

To meet the operational function, Section leaders should have some training or experience involving the supervision of fairly large numbers of people. Because operational supervision generally requires closer contact between the leader and the individual shelteree than does over-all management supervision, the operational group head should, wherever possible, be someone who is known to the group members. In most cases, operational-type leaders should be appointed by higher management, although there are some instances, specified below, where the operational leader may be elected by group members, without any loss of effectiveness.

While it is to every leader's advantage to be known and respected by the others in the group, at the level of the Division and the Department, it is less important than training or experience. The primary characteristic of the leader of the management group is supervisory ability, derived either through training or experience in managing large groups. This position should definitely be filled by appointment from top-level shelter management.

Discussion

For the following reasons, trained and experienced leaders should be appointed to direct group activities and exercise over-all control:

1. The responsibilities of these leaders for large numbers of shelterees strongly suggest that they be chosen as carefully as is possible under shelter conditions. Selection on the basis of past experience is probably a more effective way to get competent operational and management leadership than election of leaders by shelterees.

2. Appointment of leaders will result in a more efficient distribution of leadership over the entire shelter.

3. In large shelters, leadership can be established more rapidly through appointment than via elections.

Modifiers

1. Size of shelter: The larger the population of the shelter, the more desirable it is that operational and management control be in the hands of appointed leaders, who will have training and/or experience in planning, coordinating, and implementing activities. The psychological function should still largely depend upon elected leaders.

2. Facilities: The lower the level of survival supplies and equipment, the more desirable it is that operational and management control be in the hands of appointed leaders. The reason is simply that the lower the level of supplies, the greater the number of management problems that can be anticipated, which will require competent and ingenious group leaders. Under these conditions, it is also more desirable for the "psychological leader" to be selected by the shelterees.

3. Population characteristics: The characteristics of the shelter population affect largely the psychological function of community grouping. The more homogeneous the group is, the greater the tendency, and also the greater the desirability that the leaders have similar background characteristics to those of group members. If groups are very heterogeneous, it may even be necessary to appoint Unit leaders when group members may find it difficult to agree upon an elected official. Even if one is elected, resentment and perhaps opposition to him may persist within the group. Higher management appointment of a leader, especially a trained or experienced one, may ease the possibility of intra-group conflict over leadership selection.

4. Pre-trained management: The greater the extent of pre-trained management, the greater will be the desirability of assigning rather than electing leaders. Because pre-trained personnel should form the nucleus of the leadership cadre, they should be assigned to positions in order to utilize training and skills appropriately.

5. Pre-knowledge among shelterees: The greater the extent to which shelterees know each other, the greater the possibility that effective leadership will result from shelteree elections.

6. Pre-organization of shelterees: If many of the shelterees belong to one or several pre-existing organizations, shelter leadership should be related as much as possible to the leadership structure of that organization. Because it takes time for new leaders to be fully accepted, it is advantageous to utilize an already accepted set of leaders to the utmost extent compatible with other shelter goals.

The Principles of Shelteree Assignment

General Principles

The psychological and management functions of community grouping have an optimum method of shelteree assignment associated with them. The psychological function is best supported by assigning shelterees to groups in accordance with pre-existing friendship or kinship patterns, and secondly, by assigning on the basis of expressed common interests or similarities in background.

From the management point of view, assignment should be determined by entry, with a "first come, first assigned" procedure. Even more effective, keeping in mind management goals, is assignment on the basis of positions in pre-existing organization.

Discussion

Assignment of shelterees on the basis of friendship, kinship, or common interest is consistent with what has been stated previously about the psychological function of community grouping. Such assignment criteria will maximize the cohesiveness of shelter groups.

Entry or pre-organization is the most efficient basis for assignment as far as management control is concerned, since it can be done as shelterees arrive, and requires no special information about people, background, skills, etc.

Modifiers

1. Group size: The greater the size of the shelter, the greater the likelihood that people with similar backgrounds and skills are present in shelter, but the greater will be the difficulty in matching them. Therefore, the greater the number of people in shelter, the more reasonable it is to group shelterees initially by entry or pre-assigned positions. (See Shelteree Mobility.)

2. Shelter configuration: The greater the number of separate shelter areas, the easier will be the task of assignment, regardless of what method is used to group shelterees. Being able to direct a number of people to a specific room or physically separated area will be a convenience in organizing manageable population units.

3. Facilities. The poorer the level of facilities or the longer the estimated duration of stay in shelter, the more important it is that shelterees' emotional needs be satisfied by community grouping. Therefore, the more necessary it is to form smal groups on the basis of cohesion-producing criteria--common interest, friendship.

4. Population characteristics: The more homogeneous the shelter population, the easier it will be to utilize common interests as a criterion for community grouping. However, if the shelter population is of a very heterogeneous nature, the more reasonable it is to base initial assignment on entry.

5. Pre-organized shelterees: Where a large number of shelterees belong to one or several pre-existing organizations, their positions in these organizations should provide the basis for their shelter assignments, wherever possible.

The Principles of Shelteree Mobility

General Principles

The shelter cannot be a completely rigid and inflexible system. Movement of shelterees between groups should be permitted to the extent that it accomplishes a useful purpose and does not degrade shelter capabilities. Shelteree mobility will generally support the psychological function of community groups. Reassignment should take place to re-unite separated families, friends and to organize groups which are as compatible as possible. Mobility may also be used to provide shelterees with a change of shelter "scenery" during an extended period of confinement.

However, excessive shelter mobility tends to decrease manageability, although several types of reassignment are valuable or necessary for command/control. For instance, group reassignment can be a common method of social control. Also, if shelterees with specific tasks become incapacitated, others must be reassigned to fill the vacant positions.

Discussion

Under a wide variety of shelter conditions, some of which are described in the grouping recommendations, community groups must be organized initially on the basis of entry so that operations can begin in the shelter. Because this mode of assignment can lead to ineffective grouping arrangements, some amount of regrouping can be expected to place the population into psychologically meaningful groupings, as soon as the shelter is organized and the population has begun to calm down.

The use of mobility to maintain social control involves identifying potential sources of interpersonal conflict and separating the antagonists by transferring them to other groups. This procedure may be followed in cases of actual or potential rule-breaking of a minor nature.

Modifiers

1. Size of shelter: As the size of the shelter increases, there will be an increased need for mobility, and at the same time, a greater need for tight management control on mobility.

In a large shelter, uncontrolled movement from one group to another can undo much of the benefit of community grouping. Grouping benefits begin to accrue when a number of individuals who have been assigned together begin to think of themselves as a group. Indiscriminate movement between groups will tend to inhibit the formation of feelings of group identity. In a small shelter, this is not so much a problem, because people generally can identify with all others as members of a common group--the shelter.

2. Shelter configuration: The greater the separation between areas of a single shelter facility, the fewer the opportunities for movement from one to the other.

It is obvious that if shelter areas are non-contiguous; that is, separated by distance, it will be more difficult to move from one to the other. Frequently, as in the case of multiple floor shelters, movement between areas will involve utilizing stairways and passageways with a low protection factor. In addition, the more distant the shelter areas are one from another the less likelihood there is of knowing about friends and perhaps even family members who are in other parts of a single multi-unit shelter facility.

3. Shelter facilities: In shelters with very limited survival stocks, movement between groups should not be encouraged. Where supplies are minimal, strong, positive group feelings towards survival are important. As already indicated, unlimited movement between groups may weaken group cohesiveness. Another reason for limiting mobility is that management may want to tighten control over shelteree behavior to prevent the inappropriate use of available supplies.

4. Population characteristics: The more homogeneous the background of the shelterees is, the less the need for mobility. In a shelter with a heterogeneous mix of ages and social backgrounds, there will be a tendency for shelterees to seek out and interact with people of similar characteristics. This means that there will probably be pressures on management to permit shelteree mobility.

5. Pre-knowledge of shelterees: Pre-knowledge of other shelterees can have opposite effects upon the need for mobility, depending upon the nature and extent of friendship or kinship. If shelter occupants are generally and extensively acquainted with one another, the need for mobility is lessened. However, if the population is composed of many small cliques or family units, the desirability of keeping such units together may increase the need for reassignment.

6. Pre-organization of shelterees: The greater the number of shelters who belong to one or several pre-existing organizations, the less the necessity for extensive shelter mobility.

V GROUPING RECOMMENDATIONS

Grouping recommendations are statements about group size and structure that constitute the suggested solutions to the problem of organizing a community shelter into manageable population units.

In addition to specifying grouping principles, these recommendations serve to resolve conflicting principles. The chapter on Grouping Principles contains frequent instances where two principles clash in regard to a single grouping dimension. For example, under specified conditions, the principle relating to emotional needs may call for small groups, while the principle of management control may suggest larger groups. To resolve these dilemmas wherever possible, the recommendations reflect an evaluation of the conflicting principles, and the conditions under which each grouping alternative is in closest harmony with the over-all goals of the shelter: the physical survival and mental well-being of the population.

There are five parts to the Recommendations chapter. The first consists of several statements that apply to all types of groups. Following this is a series of recommendations about the Unit (the small shelter group of between 7-12 persons, that is central to the satisfaction of shelteree emotional needs). The third set of recommendations pertains to the Section (the medium sized activity-oriented group of between 40-60 people). The fourth set of recommendations concerns the Division (the management grouping level of between 200-300 shelterees). Lastly, there are a few recommendations about the Department, the giant, autonomous, administrative level found in the large shelters.

The Unit is discussed first because the recommendations are presented in the order of group size. In terms of importance, however, the Section is the key community group, followed closely by the Division.

General Recommendations

The following few recommendations apply to all levels of the community group.

Shelter Configuration

The physical configuration of the shelter should be given strong consideration in sub-grouping the population. The following recommendations apply if there are a number of separate areas in a particular shelter:

1. The size of shelter groups, especially that of the Section and Division, should conform to the size of the available separate areas. For example, if a shelter consists of many rooms, each with a capacity of 60 persons, the size of the Section should be 60.

2. The group that is organized first should be the group that conforms most closely to the size of the available separate areas. Using the above example, it would be more reasonable to assign shelterees to the Section first and then combining Sections into Divisions. Initial assignment to Divisions is ineffective if the Divisions are immediately divided into a number of physically separated 60-man Sections.

3. Operational responsibility for community group activities should be centered in the group that conforms to the size of the separate shelter areas, especially if these areas are non-contiguous. Still using the above example, it would be difficult for a Division head to supervise group activities taking place in four or five physically separated Sections. If at all possible, the Section head (in this example) should be assigned responsibility for group activities.

Pre-Organization of Shelterees

If a large proportion of the shelterees are members of one or several pre-existing organizations, this organization should provide the basic pattern for shelter group sizes and structure, assignment of leaders and members. The pre-existing organization should be incorporated into shelter groups, to the extent that the grouping patterns of the former are compatible with the requirements for shelter survival.

Uniformity of Group Dimensions

Within each level of shelter grouping, uniformity in the size of subgroups is not a requirement, as long as groups are not disproportionately

sized. Within each group, there should be as much uniformity as possible in procedures dealing with assignment of leaders and shelterees, and subgroup responsibilities.

The Unit

Size of the Unit

1. The recommended size range of the Unit is around 7-12.

2. The selection of the Unit size should be left to the discretion of the Section leader, who can be guided by the following general considerations:

   a. The size of the Unit should tend toward the lower end of the recommended range if more than one of the following conditions exists:

      (1) Small Section
      (2) Trained Section leader
      (3) If the Section contains heterogeneous elements which could tend to group naturally in smaller Units.

   b. The size of the Unit should tend toward the larger end of the recommended range if more than one of the following conditions prevail:

      (1) Large Section
      (2) Untrained Section leader
      (3) Homogeneous population

3. Uniformity in the size of Units is of little importance as long as Units remain within the recommended size range.

Structure of the Unit

1. All Units should have a leader.

2. Additional formal organization within the Unit is not necessary; however, the Unit leader, at his discretion, may select an assistant Unit head, or further subdivide his Unit.

Responsibilities of the Unit

1. The Unit leader is responsible for maintaining order and control of his group.

2. The Unit leader is responsible for carrying out those duties to which the Section leader assigns him.

3. The Unit leader conveys complaints and problems of individual shelterees to the Section leader.

4. The Unit leader is responsible for counseling, advising, and consoling individual shelterees.

Timing of Formation of the Unit

1. Units are formed after other groups have been established and permanent leaders appointed.

2. In very small shelters (50-100 people), when the Unit is the only population grouping, the formation of Units may be delayed until after initial operations have been undertaken for the shelter at large.

Selection of Unit Leaders

1. Unit leaders should be elected by the members of the Unit.

2. Under the following conditions, the Unit head may be appointed by shelter management:

   a. If Unit members cannot be expected to elect a head, as in schools where shelterees are mainly children.

   b. If the shelter is small, and a number of experienced management personnel are available.

Assignment of Shelterees to the Unit

1. Shelterees should be assigned to Units on the basis of kinship, friendship, and common interests.

2. Any informal grouping which occurs prior to Unit formation should be utilized in the assignment of individuals to Units.

Reassignment of Shelterees to Units

Reassignment to Units is likely to be minimal, since they are formed late and on the basis of more information than the other grouping levels.

The Section

Size of Section

1. The recommended size range of the Section is around 40-60.

2. The size of the Section should tend towards the lower end of the recommended range if more than one of the following conditions pertain:

   a. The shelter is small in size (200-400).

   b. The Division is organized first and is small in size.

   c. Survival supplies and equipment are at a very low level.

   d. The members who will compose the Section are very heterogeneous in respect to age, sex, and social background.

   e. There are few people who know each other among the members of the Section.

   f. There are no trained or experienced management personnel to place in the positions of Section heads.

3. The size of the Section should tend towards the upper end of the recommended range if more than one of the following conditions pertain:

   a. The shelter is large in size (1000 or more).

   b. The Division is organized first and is large in size.

   c. Prospective Section members are largely homogeneous in regard to age, sex, and social background.

   d. Section members are acquainted, friendly with, or related to each other.

   e. There are sufficient trained or experienced personnel to fill the positions of Division leaders.

4. It is not necessary to achieve uniformity in the size of Sections, so long as they are not disproportionately sized.

5. If Section size has not been pre-arranged at the time of entry, it should be determined by the Shelter Manager, or the Department head in large shelters, before or upon initiation of community grouping.

Structure of the Section

1. The Section should be organized into Units. Within limits, the number and size of the Units and the relationship between Units are at the discretion of the Section leader, who should coordinate with the Division leader.

2. The limit upon the number of Units in a Section is normally seven. However, under the following conditions, the number of Units in a Section may be as high as ten.

   a. Very small shelters (50-150 capacity).
   b. Shelters with highly trained or experienced Section heads.

Responsibilities of the Section

1. The Section is always directly involved in carrying out community group activities. Consequently, the Section head almost always has direct operational supervision over his group. Operational supervision means that the Section head is responsible to his management superiors for the performance of all members of the Section in community group activities.

2. Under the following conditions, the Section head may also be vested with management responsibility, which includes planning and coordination of operations.

   a. The shelter is very small in size (no divisional level of grouping).

   b. The shelter consists of small, non-contiguous areas at a distance from each other.

   c. The Section heads are highly trained or experienced personnel.

3. Under other conditions, operational supervision may be shared between Division and Section heads. This means that as far as the Shelter Manager is concerned, the Division head is responsible for community group activities, but within each Division, the activities are still immediately supervised by Section heads.

   a. The shelter is very large in size (1000 and over).

   b. There are trained or experienced management personnel at the Division level, but not at the Section level.

4. In addition to operational supervision, the Section head is responsible to his superiors for the behavior and the well-being of all members of his group.

5. Typical operational responsibilities of the Section head include:

   a. Insuring that individual shelterees are provided with food, water, and other necessary supplies; insuring that sleep arrangements are made for all shelterees.

   b. Maintaining sanitary standards in Section area.

   c. Supervising Section members' participation in training and education.

   d. Supervising Section members' participation in social and recreational activities.

   e. Supervising service activities, such as baby sitting, practical nursing for aged and infirm people.

   f. Maintaining communication between management and the shelterees, including feedback of information on shelteree needs, complaints, etc., filling out of registration forms.

   g. Maintaining order among shelterees (although the Section leader does not invoke penalties for rule violations. This is normally the duty of the Division head or the Manager).

   h. Maintaining 'mental health' of shelterees by counseling (in cases where Unit leaders cannot solve shelteree emotional problems).

Timing of Formation of the Section

1. Under the following conditions, shelterees are assigned to the Section first, and subsequently to other groups:

   a. The shelter is small (under 400).

   b. Pre-selected management personnel are available at time of entry to fill position of Section head.

   c. The shelter contains separate areas (rooms, floors) with a capacity within the size range of the Section.

2. Under the following conditions, the Section and the Division are organized almost simultaneously:

   a. The shelter is of medium size (500-1000).

   b. The shelter is of large size, but there are pre-selected management personnel available as Section heads.

Selection of Section Leaders

1. Section leaders should be appointed by management. If they have not been pre-selected, they should be appointed by the Division leader, prior to initiation of community grouping. Selection should be on the basis of Division head's personal knowledge of Section leader or on the basis of information in shelteree registration forms.

2. Section leaders should have some previous experience in supervising fairly large groups of people. Generally speaking, males would be desirable as Section heads. It may be assumed that a female group leader would encounter resistance from certain population elements, in carrying out Section leader responsibilities.

3. If Sections are made up largely of people with similar backgrounds, it is recommended that a Section leader with characteristics similar to those of the vast majority be appointed, when possible.

4. In small shelters, occupied by people who are largely friends and acquaintances (e.g. a shelter in a garden apartment basement), Section leaders may be elected by the shelterees.

5. If it is desirable to appoint people in charge of Sections before registration form data can be processed, and in the absence of experienced people known to shelter management, temporary Section heads can be selected by asking for experienced management people to volunteer. The purpose of temporary Section heads is to get some operational supervision in order to carry out initial protective actions and shelter operations.

Assignment of Shelterees to the Section

Assignment of shelterees to the Section is by time of entry into the shelter, unless there is a pre-organized basis for assignment.

Reassignment of Shelterees

Reassignment between Sections should be permitted when necessary:

a. To reunite family and close friends who are in another Section.

b. To prevent individuals from becoming "isolates" within a Section. For example, if there are one or two old persons in a Section otherwise exclusively composed of younger adults, it may be advisable to reassign the former.

c. To maintain a balance of family groups throughout as many Sections as possible in order to have them function as a source of stability.

The Division

The Division is necessary for shelters having populations greater than 500, although it may sometimes be desirable for shelters of 300-400.

Size of the Division

1. The recommended size of the Division is around 200-300.

2. The size of the Division should tend toward the lower end of the recommended range, if more than one of the following conditions prevail:

   a. No trained management at the Division level.
   b. Small shelter population.
   c. Survival supplies and equipment at a low level.

3. The size of the Division should tend toward the upper end of the recommended range, if more than one of the following conditions occur:

   a. The shelter population is large (1000 or over).
   b. Some trained Division leaders are available.

4. It is not necessary to achieve uniformity in size of the Division, but it is desirable to keep inequalities at a minimum. Uniformity at this level is more important than at the level of the Section.

5. If the Division size has not been pre-arranged at the time of entry, it should be determined by the Shelter Manager, or the Department leader, upon initial organization of the Division.

Structure of the Division

1. The detailed structure of the Division is determined by shelter management staff or the Department staff.

2. The Division should be organized into Sections, which conform in size to those recommendations regarding Sections.

3. The number of Sections in a Division should be less than seven, preferably four to six.

4. The number of Sections should be fewer if the Division leader is untrained.

5. The number of Sections may be greater if the Division leader is trained, of if the Sections are smaller (see Size of Section, p.60) due to heterogeneity of shelter population.

Responsibilities of the Division

1. Most or all management responsibilities will be centered at the Division level under the following conditions:

   a. Large shelters (1000 or over).
   b. Divisions are located in non-contiguous areas.
   c. There is shift-eating and sleeping.
   d. There is a low level of facilities.

2. Managerial responsibilities and operational supervision for the following activities should be centered at the Division level.

   a. Dispensing supplies to Sections (e.g. food and water).
   b. Assignment of sleeping space.
   c. Medical procedures (sick call).
   d. Record taking and communication with core staff.
   e. Invoking penalties for minor types of deviant behavior.
   f. Training and education of shelterees.

Timing of Formation of the Division

1. Under the following conditions, shelterees are assigned initially to the Division:

   a. The shelter is large.

   b. The shelter contains physically separate areas of a capacity within the size range of the Division.

   c. There exists trained management down to the level of Division only.

2. For further information on this topic, see Section.

Selection of Division Leaders

1. Division leaders should be appointed by management, prior to initiation of group formation.

2. Appointment of Division leaders should be done on the basis of a pre-knowledge of the qualifications of the individual. If management has no prior information about the shelterees, temporary Division leaders may

be selected from available technical staff members who do not have immediate responsibilities (such as radiation monitoring). Permanent leaders then may be chosen on the basis of information from registration forms, plus brief interviews with the likely candidates.

3. If no core staff is available and leaders have not been pre-selected, temporary leaders should be selected from early entrants and permanent leaders chosen later as above.

4. Division leaders should be males who have some previous experience in supervising large numbers of people. If trained or experienced females are in a shelter, they certainly should be given management responsibilities. However, in many shelters, authority vested in a male will probably be accepted more readily than in a female.

Assignment of Shelterees to the Division

1. Assignment of shelterees to the Division should be on the basis of time of entry to shelter, unless pre-organization provides a basis for assignment.

2. Reassignment to other Divisions should only take place if it is necessary to re-unite families, to provide a more equal distribution of the population to shelter areas, or to distribute skilled persons throughout the shelter.

The Department

This grouping level will be necessary for shelters having populations exceeding 3000. It may also be desirable for populations of between 2000 and 3000. It provides another management level, and is, therefore, chiefly of benefit to core management. The term "department" usually refers to a large segment of an organization with a special set of functions. However, in a community shelter, all departments will have similar functions. The term "department" has been selected because of its connotations of size and complexity; no connotation of specialization is intended.

Size of the Group

The recommended size range of this level is around 1000-1500.

Structure of the Group

Assistants to the Department head should be formally appointed, setting up, in effect, a core staff for this level. This means that the number of Divisions in such a level can be relatively large, and Divisions can be smaller than would be the case if there were a single leader for the level.

Responsibilities of the Group

The Department head will exercise command/control over all Divisions and Sections within his Department. In many cases, Departments will function with almost complete autonomy. This is especially likely where shelter areas are non-contiguous.

Selection of Group Leaders

If at all possible, Department heads should be selected prior to shelter occupancy, and provided with the same training as a Shelter Manager would receive. In the event that pre-selected Department heads are not available, they will have to be carefully chosen by the Manager, from the incoming population, using the same procedures that apply to the in-shelter selection of Division heads.

VII. APPLICATION OF GROUPING RECOMMENDATIONS TO SELECTED SHELTER SYSTEMS

In the two previous chapters, grouping principles and recommendations were discussed in a fragmented manner. In the Principles chapter, group dimensions were discussed singly, while in the Recommendations chapter, each type of shelter group was dealt with separately. The approach to principles and recommendations did not attempt to scrutinize multiple grouping dimensions simultaneously, play them against a plurality of shelter variables, and emerge with "trade-off" recommendations. That is the task of the chapter that follows.

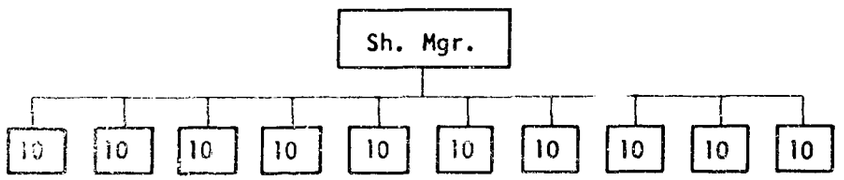
In this portion of the research, a number of hypothetical, but not unrealistic, shelter systems are described; recommendations for group size, structure, etc., are generated for each system, followed by a commentary on the reasoning underlying the grouping, including alternative approaches to organization.

Organization of Community Groups in a 100-Person Shelter

1. Standard Organization

Hypothesized Shelter Condition: Most shelterees are adults, from the same work organization and of similar social backgrounds; the shelter has adequate survival supplies in shelter.

Organization Chart:



Number of Management Levels: Two

Number and Size of Groups: Ten units of ten each[1]

Center of Group Responsibility: Most daily activities will be carried out on shelter-wide basis. Some, such as recreational or other social activities may be organized about the Unit.

Timing of Group Formation: Because only one type of group exists, there is no question of which group to assign shelterees to first. Also, in a shelter such as this one, formal grouping into Units can be delayed if necessary. The shelter is small enough for immediate protective actions to be implemented

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[1] It should be clear that there is no survival value in exactly matching the recommended numbers for each group in an actual shelter situation. Actual shelter groups will vary in size, regardless of how hard the Manager may try to round them off evenly. The numbers in these examples are norms, which reflect primarily, our guidance principles, and secondarily, our penchant for correct arithmetic.

on a shelter-wide basis, during which time the entire shelter functions as a single group.

Selection of Leaders: Unit leaders will probably be elected by members of each Unit. If there are experienced management personnel in-shelter (although not CD trained), the Manager may decide to assign Unit leaders.

Assignment of Shelterees to Groups: Groups will be most likely based on pre-knowledge or common interests. However, if shelterees do not group together naturally, the Manager may either ask them to form into Units, or perhaps assign them to units from the information on their shelter registration cards.

Shelteree Mobility: In such a small shelter, this will probably not be too high or much of a problem.

Discussion: This is the simplest form of shelter organization. In a shelter of 100 or so inhabitants, the number and size of each Unit is quite flexible. The basic community group will be the shelter as a whole with most operations and activities carried out on a shelter-wide basis by direct communitcations from the Manager to all shelterees. Within limits, therefore, the number of Units and size of each is almost irrelevant to effective command/control. "Within limits" means that one would not recommend 25 groups or four persons each or two groups of 50 persons each. In this shelter, the specific number and size of Units could be determined by:

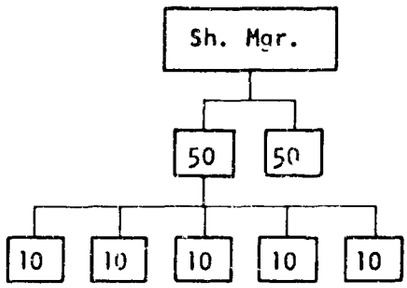
(1) the natural pre-shelter grouping of the population,

(2) the configuration of the shelter, if many separate areas are available.

2. Alternative Organization

Hypothesized Shelter Conditions: Under a set of adverse shelter conditions, such as very limited survival supplies, and a heterogeneous population mix of ages, sex, and social background, and an absence of family or acquaintances, a different organization of the 100-person shelter may be considered.

Organization Chart·



Number of Management Levels: Three

Size of Group: 2 Sections of 50 each. 10 Units of 10 each.

Center of Group Responsibility: Responsibilities will be divided between the Section and the Shelter Manager.

Timing of Group Formation: Shelterees should be organized first into Sections, then subdivided into Units as scon after entry as possible.

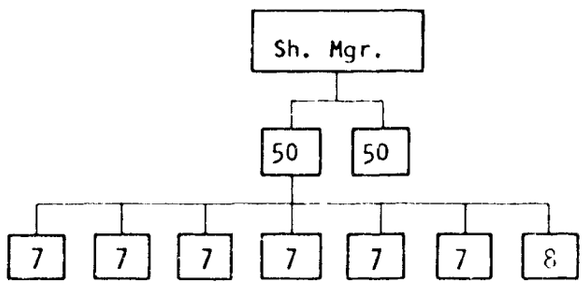
Selection of Leaders: Section leaders will be selected by management. In this shelter system, several trained leaders should be available as Section leaders. Because of population heterogeneity, there may be no early agreement on elected Unit leaders. In such cases, they may be selected by the Section leaders on the basis of information in the registration forms.

Assignment of Shelterees to Groups: Given the population characteristics of this shelter, initial assignment may reasonably be based on entry. This may be subsequently modified by common interests, as expressed in the registration forms.

Shelteree Mobility: Under the conditions specified, mobility will probably be high. It would be beneficial to match members of the Unit in terms of common interest.
Note: This is not a recommendation for racially or ethnically segregated Units. The only generalizable basis for acceptable segregation is sex, and possibly age. If there are only a few women in a shelter, it may be desirable to group them in a Unit unto themselves. However, before establishing a procedure, it would be advisable to check with the women.

Discussion: Because of the heterogeneity of the population and the limited supplies, this 100 person shelter was organized on three levels. These two conditions imply that the Manager will face numerous problems in directing the shelter; consequently, close control over individual shelterees will be desirable. To accomplish such control, the Manager should delegate responsibilities directly to the Section heads.

The principle of group size suggests that, the poorer shelter conditions are, the smaller groups should be. Given the conditions of this shelter, it is not inconceivable, although it may be highly academic, to suggest, as a form of organization:



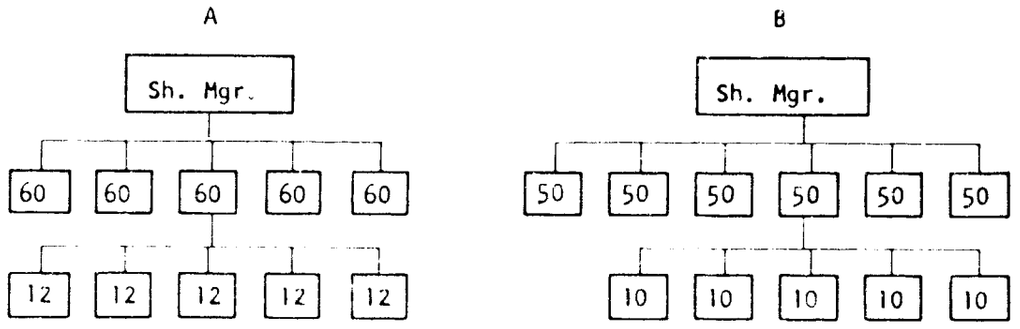
As stated above, in a 100-person shelter, the size of the Unit is not a critical grouping factor, if it remains within the 7-12 range.

Organization of
Community Groups in a 300-Person Shelter

1. Standard Organization

Hypothesized Shelter Conditions: The shelter characteristics are as follows: Shelter occupants from same neighborhood, of similar social background, with not too many children or aged persons; some trained management; adequate survival stocks. The shelter consists of a single basement floor.

Organization Chart:



Number of Management Levels: Three

Number and Size of Groups: System A: 5 Sections with 60 each
25 Units with 12 each

System B: 6 Sections with 50 each
30 Sections with 10 each

Center of Group Responsibilities: In both variations of the standard organization, group responsibilities will mostly be associated with the Section level.

Timing of Group Formation: The group of initial assignment in both shelter variations should be the Section.

Selection of Leaders: Section heads will be selected by management from among trained or experienced personnel. The characteristics of the population in this shelter indicates that Unit elections are the best method for selecting Unit heads.

Assignment of Shelterees to Groups: Pre-knowledge or common interest would likely be the major determinant in assigning the relatively homogeneous population to Units and possibly even to Sections.

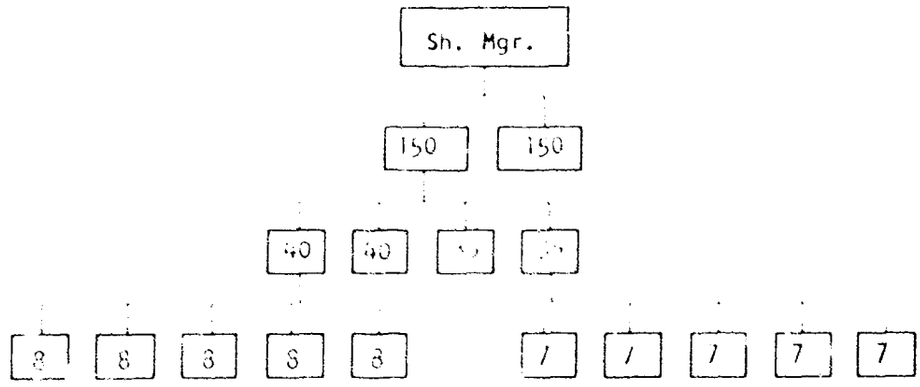
Shelteree Mobility: Under these circumstances, the movement of shelterees from group to group is likely to be neither a necessity nor a problem.

Discussion: Shelter system 3 A and 3 B are only slightly different, standard grouping approaches to the 300-person shelter under non-extreme conditions. The distinction between the two systems lies in the size of the Sections and Units, with the chief outcome that the Shelter Manager has an additional Section head with whom to interact in the 6 x 50 shelter. Actually, there is little difference between the two systems.

2. Alternative Organization

Hypothesized Shelter Conditions: Shelter occupants are largely strangers of mixed backgrounds, including a number of children; minimum amount of equipment and supplies; few trained or experienced management personnel and a long shelter stay forecast. Shelter consists of several distinct but contiguous areas.

Organization Chart:



Number of Management Levels: Four

Size of Groups: 2 Divisions of 150 each
4 Sections of 40 each
4 Sections of 35 each
20 Units of 8 each
20 Units of 7 each

Center of Group Responsibilities: Activities will be divided between the Division and the Section.

Timing of Group Formation: Either the Division can be formed first and then subdivided, or Sections formed first and combined.

Selection of Leaders: Division and Section leaders will be selected by the Manager from trained or experienced people. Unit leaders will be elected by Unit members; however, since all shelterees are unacquainted, the Manager may decide to select Unit leaders from registration form data.

Assignment of Shelterees: Initial assignment will probably be on the basis of entry and modified later to achieve the most homogeneous grouping of shelterees.

Shelteree Mobility: Group reassignment will likely be high as the initial organization is modified by the Manager on the basis of common interests, as shown from registration forms, or by requests from shelterees as they become acquainted.

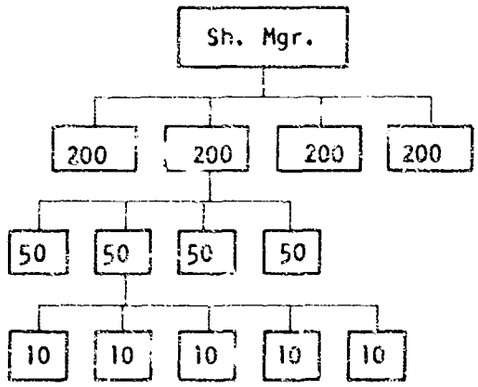
Discussion: This example illustrates one approach to grouping a shelter of 300 under adverse conditions. In this case, the size of all groups is rather small. The poorer the shelter conditions, the more management should strive for smaller groupings to increase control over shelterees, and to maximize the opportunity for development of cohesive groups. Although the existence of several separate shelter areas (as specified in the conditions) was an important consideration in setting up a Division level of 150, this decision could also have been reached, given a single-spaced shelter plus the population characteristics and the level of facilities of this shelter.

Organization of Community Groups in a 800-Person Shelter

1. Standard Organization

Hypothesized Shelter Conditions: No extreme conditions prevail.

Organization Chart:



Number of Management Levels: Four

Number and Size of Groups: 4 Divisions with 200 each
15 Sections with 50 each
80 Units with 10 each

Center of Group Responsibilities: Activities will largely be carried out at the Section level, with a few activities organized around the Division.

Time of Group Formation: Ideally, the Section should be the group to which shelterees are initially assigned. However, if there are trained or experienced management personnel in the positions of Division leader, but not

enough trained or experienced Section heads, the shelterees may first be assigned to the Division and then to Sections and Units.

Selection of Leaders: Division heads will be selected by Shelter Manager on basis of training or experience. Section heads will be selected by Division leaders in similar fashion. Unit heads should be elected by shelterees.

Assignment of Shelterees to Groups: If shelterees are initially assigned to the Division it is likely that this will be done on the basis of entry or some form of pre-assignment. Sections will then be formed either by pre-assignment or sub-grouping of the Division into equal-sized Sections. The Unit will most frequently be organized around pre-knowledge or common interests. If shelterees are assigned to a Section first, then a Division will be formed as a combination of Sections. Assignment to the Unit should remain unchanged.

Shelteree Mobility: In an 800-person and larger shelter, regrouping may be necessary, especially if the initial organization was based on entry. To maintain over-all control of the shelter, however, mobility should be strictly supervised by management.

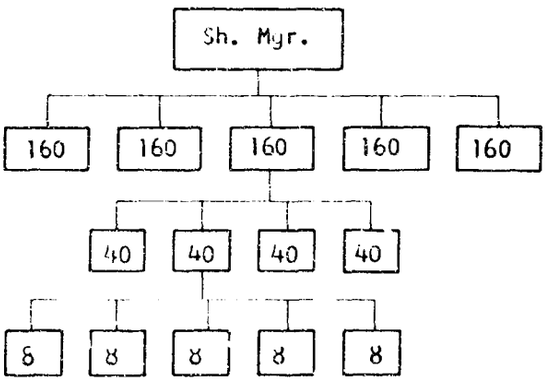
Discussion: This seems to be the most natural form of grouping for an 800-person shelter, under a wide range of conditions. The 800-person shelter exhibits some dramatic command/control distinctions from the 100- and 300-size shelter. In the 100-person shelter, and to a degree, in the 300-person shelter, the Manager can be aware of much of what is happening in this facility. In the 800-person shelter, this is patently impossible. Delegation of authority to intervening management levels is an absolute necessity if activities and operations are to be carried out on a planned and supervised basis.

From the shelteree point of view, too, the 800-person shelter is different from the smaller ones previously discussed. In the smaller shelters, and especially in the 100-person one, it is easy for shelterees to perceive the shelter as a single group, and as such, identify with it. The chances of this occurring in an 800-person shelter are slim. Shelterees will identify with sub-groups of a shelter system, and will tend to look for leadership to the sub-group leaders (Division and Section heads). In large shelters the Shelter Manager and his immediate staff will be more and more occupied with the problems of over-all direction and coordination of the shelter. As a result, the role of the Division and Section leader become paramount in directing community group activities.

2. Alternative Organization

Hypothesized Shelter Conditions: The following conditions may require an alternative organization: heterogeneous population mix, few acquaintances and families, minimal survival stocks, more than one physically separate shelter area, and few trained or experienced personnel.

Organization Chart:



Number of Management Levels: Four

Number and Size of Groups: 5 Divisions with 160 each
20 Sections with 40 each
100 Units with 8 each

Center of Group Responsibilities: Activities will be divided between the Division and the Section, although more activities will probably be carried out at Division level than under standard organization.

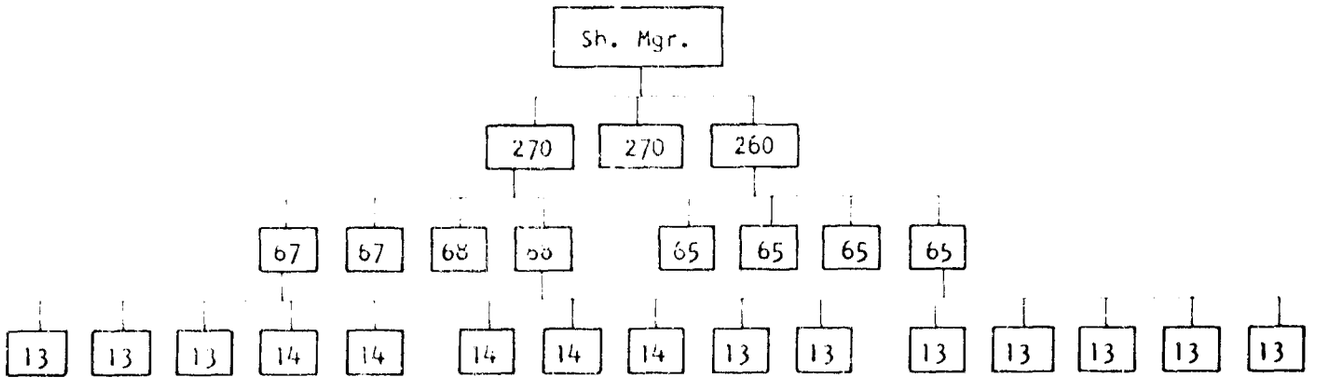
Other grouping dimensions will be essentially unchanged from standard organization.

Discussion: The alternative organization of an 800-person shelter does not differ radically from that of the standard organization. The major difference

will be one additional division with smaller groupings. By itself, this difference would not warrant discussion of an alternative organization. However, the small distinctions between the two structures do point out a central dilemma in the sub-grouping of large shelters--the conflicting demands imposed by the psychological and management functions of community groups. From the standpoint of shelteree emotional needs, community groups, especially at the Unit level and to some extent the Section, should be small and the number of management levels at a minimum. To the contrary, grouping criteria for effective over-all management control leads to the establishment of larger groups and more management levels. This dilemma may not arise at the 100- and 300-person shelter, but it does become an increasing, organizational problem as the shelter increases in size. This organizational dilemma is made more acute where the shelter has only a minimum level of shelter supplies.

In the alternative organization, illustrated above, the solution is in the direction of the psychological function--smaller sized groups, with the anticipated results of, hopefully, more cohesive groups and greater shelteree motivation. Some of the important considerations that would dictate such a choice are: (1) population heterogeneity (mixed ages and social backgrounds), (2) lack of pre-knowledge among shelterees, (3) the shelter configuration--in this case perhaps, five separate shelter areas, each of which can house a Division, and (4) adequate number of trained or experienced personnel to take over all groups at the Section and Division levels.

Under another set of conditions, there is a second alternative approach to an 800-person shelter grouping which stresses the management function.



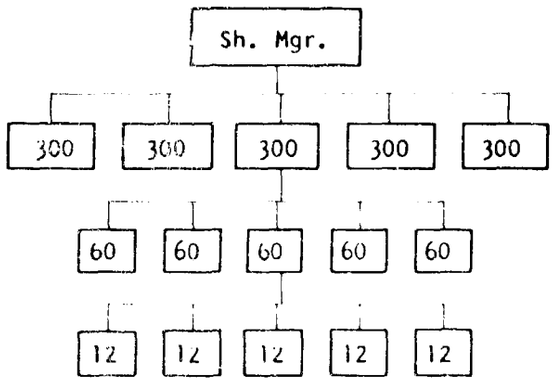
In this case, the psychological function becomes secondary to the management. The conditions which might make such an organization structure desirable include: an extremely homogeneous population, one where most people know each other, or a shelter configuration with three large separate areas with very well trained or highly experienced management personnel to occupy the positions of Division heads.

Organization of Community Groups in a 1500-Person Shelter

1. Standard Organization

Hypothesized Shelter Conditions: No extreme conditions prevail.

Organization Chart:



Number of Management Levels: Four

Number and Size of Groups: 5 Divisions of 300 each
25 Sections of 60 each
125 Units of 12 each

Center of Group Responsibilities: Community activities will largely be undertaken at the Section level, with some at the Division level.

Timing of Group Formation: Divisions and Sections should be formed almost simultaneously, as soon after entry as possible. Units can be formed after initial shelter operations have been undertaken.

Selection of Leaders: Division heads and Section heads will be appointed by top shelter management on the basis of experience or training. Unit heads should be elected by members of the Units.

Assignment of Shelterees to Groups: Using entry as the criterion, assignment should be made to the Division and Section almost simultaneously. Subsequent assignment to the Unit can be on the basis of common interest or friends and families if they are in the shelter.

Shelteree Mobility: As in the 800-person shelter, the need for mobility to unite families and friends and optimize Unit grouping will be great, but this mobility should be tightly regulated by shelter management.

Discussion: In a shelter of 1500 people a great many formal groups will be needed no matter what organizational structure is adopted. In this example, there will be 155 groups. Because of the different nature of the Unit, it is, perhaps, not reasonable to include the Units in the total. If the Units are excluded, 30 Sections and Divisions remain which require competent leaders. Unless the shelter is part of a pre-existing organization that will provide its own leadership in a disaster, finding this number of experienced people can be quite a task.

In addition to the dilemma of psychological versus management needs in regard to group size, which has already been discussed, another problem of shelter organization is the dilemma between the operational and management functions of community groups. As the shelter population increases, the complexity of group activities also increases. It is, therefore, desirable to have closer supervision over group activities. To maximize the chance for direct operational supervision, the group that carries out an activity (for example, eats together or trains together) should be kept small (Section size). However, from the over-all management control point of view, coordinating 25 Sections in a shelter situation can be an arduous and complicated task. One alternative is to lift the level of the operational group from the Section to the Division, with the Division head directly responsible for the implementation of the activity. In this case, it would mean 300 people completing an activity as a group. Since only five groups (Divisions) have to be taken into account by top level management, the coordination problem would be simplified; however, direct operational supervision would be quite a bit more difficult. Both alternatives have drawbacks, which would act to increase the complexity of community group activities.

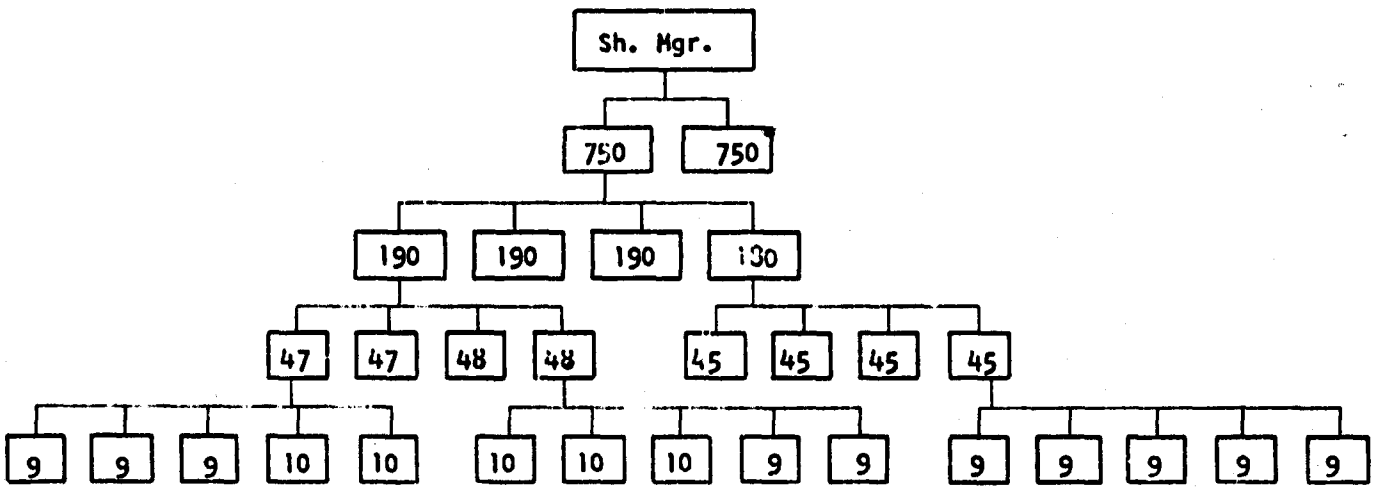
The resolution to this dilemma should be based upon a number of factors including: pre-knowledge and pre-organization of shelterees. In the presence of a high degree of either, the probability of successfully enlarging the

operational group is increased. The question of trained management also should be considered. If there are highly trained and competent people to occupy the positions of Division heads, it is more likely that the operational group can be increased in size. Also, the presence of Division size barriers in a shelter (separate rooms, floors, room dividers) will tend to aid the group enlargement.

2. Alternative Organization

Hypothesized Shelter Conditions: A shelter with multi-stories or a single level with many large rooms or areas.

Organization Chart:



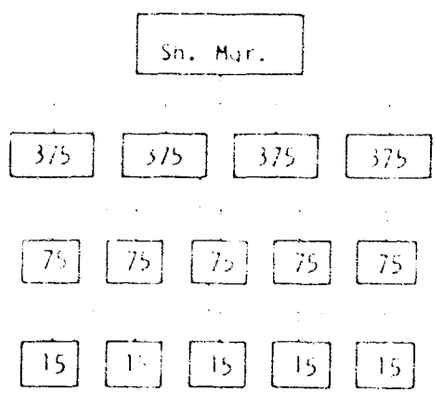
Number of Management Levels: Five

Number and Size of Groups:
2 Departments with 750 each
6 Divisions with 190 each
2 Divisions with 180 each
12 Sections with 47 each
12 Sections with 48 each
8 Sections with 45 each
100 Units of 9 each
60 Units of 10 each

Other grouping dimensions will be essentially unchanged from standard organization.

Discussion: This variation on the structure of a 1500-person shelter represents an extreme of grouping. It is composed of 202 groups, of which 42 are at the level of Section or higher. This is the organization that would likely result if the sole criterion for subdividing the population was the emotional needs of the shelterees--a rather implausible case. As unrealistic as this organizational structure appears, it may however be the grouping pattern of choice under several not unlikely sets of conditions. For example, if a single shelter facility consists of 9 or 10 floors in the core of an office building, or the same number of large physically separated areas in two sub-basements, the alternative organization, outlined above, may be the best approach to community grouping.

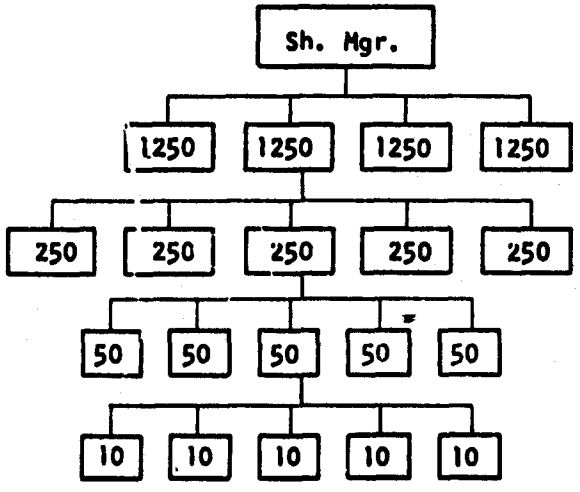
This example focuses on one of the implicit tenets of the entire study. It is that the organization of the shelter population into community groups cannot be accomplished simply by reference to sample organization charts in a guidebook. To be sure, generalized guidance can be of great value but ultimately, optimum population grouping must be determined by the characteristics of each shelter system. What are perfectly manageable population units in one shelter, might be ineffective in another shelter of the same capacity. The grouping principles and recommendations presented in this report, may be helpful as evaluation aids, but not as formulas for solving the manageable group size problem. For instance, the following variation on the 1500-person shelter organization violates several of the principles of group size, yet it might be very reasonable in a shelter composed largely of people who have known each other for a long period of time (e.g., a shelter in a large church).



Organization of Community Groups in a 5000-Person Shelter

1. Standard Organization

Organization Chart:



Number of Management Levels: Five

Number and Size of Groups: 4 Departments of 1250 each
20 Divisions of 250 each
100 Sections of 50 each
500 Units of 10 each

Center of Group Responsibilities: Community group activities will largely be organized around the Division.

Timing of Group Formation: The Division should be the group that is initially organized and to which shelterees are assigned upon entry.

Selection of Leaders: Fourth level and Division leaders should be appointed by top level management. Section leaders should generally be selected by the Division head, and Unit leaders elected by shelterees.

Assignment of Shelterees to Groups: Initial assignment to be on the oasis of entry. Subsequent reassignment within Units and perhaps Sections to reunite families, etc.

Shelteree Mobility: In such a shelter, it can be assumed that friends and relatives will be separated upon entry or prior to it. In order to reunite separated kinship and friendship groups, mobility will have to be quite high.

Discussion: In order to think about a standard organization of shelter community groups, one must have in the background an image of a standard shelter system, or several such systems, to which the grouping applies. It is, therefore, easier to suggest a generalized grouping arrangement for a shelter of 100 persons than for a shelter of 5000. For one reason, the physical dimensions and configuration of 100-person shelters have less significant variability than those of 5000 capacity shelters. Secondly, 100 persons have been studied in simulated shelter situations; there have been no such experiments with much larger groups.

The most reasonable approach to achieve manageable groups in a 5000 or larger shelter is to consider the Department as a subshelter. From the standpoint of community grouping, a 5000-person shelter is in reality three, four, or five independent systems, each organized along the lines of a 1500-person shelter (see previous example).

The standard organization (described above) merely illustrates one of the many possible ways of structuring community groups in a 5000-person shelter. The actual organization structure that is developed for a particular shelter of this size depends largely on the shelter configuration, the availability of trained management, and the presence or absence of a pre-existing organization.

VIII. EVALUATION

This chapter is concerned with evaluation in three different ways. First is evaluation of the appropriateness of grouping principles and recommendations as presented in this report. Second is evaluation in the sense of identifying the constraints under which the study was conducted and the limitations these imposed on the firmness and precision of results. Third is evaluation in the sense of selecting out of the multitude of researchable problems relating to manageable group sizes those which, on the basis of experience from this study, seem most immediately fruitful for investigation.

Evaluation of Grouping Principles and Recommendations

Grouping principles and recommendations were evaluated in two ways. First, a draft version of the report was reviewed by personnel of the Office of Civil Defense and several consultants to the project. Second, eight members of the American Institute for Research staff who were experienced in civil defense research used a series of rating scales to determine whether their independent selection of grouping alternatives would match those alternatives selected by the project staff on the basis of literature review and analysis of the problem.

Reviews and ratings generally supported the principles and recommendations formulated by the project staff. In those relatively minor instances where there appeared to be a conflict, they were generally reconciled by a clearer and expanded statement of principle or recommendation.

Limitations of the Study

The major constraint upon the study described in this report was the lack of several types of crucial theoretical and empirical information. One type of missing data pertains to the shelter system. Although habitability studies have contributed a wealth of information about shelter living, there are still numerous aspects of the shelter system, largely those of a non-physiological nature, about which there exist no "hard" data, and even very few impressionistic hypotheses.

The unavailability of detailed information about the shelter system was the basic reason for the lack of success in applying the several grouping models that were developed during the project.

The second data gap is in the area of grouping dimensions, especially group size. The behavioral science literature has produced little in the

way of empirical data or theoretical propositions relevant to our study, on the subject of large groups in general, and even less on groups under disaster conditions. It was our hope to discover what we call grouping principles, in the behavioral sciences literature, or at lesst to find therein empirical evidence upon which to construct such principles. Neither the principles nor the data were forthcoming. Consequently, a much larger portion of project time than intended was spent in deriving grouping principles from the available source materials that lent themselves to reasonable inferences about shelter grouping.

Suggestions for Further Research

As a result of this study, the project personnel feel that further research is needed, to serve two main purposes: (1) to generate hypotheses about grouping that are relevant to the shelter system and, (2) to verify grouping hypotheses through empirical investigation of groups under a wide variety of experimental conditions. What follows are some general and specific suggestions for future research that have emerged from the present study.

1. Research on the "medium group". The literature abounds with investigations of all conceivable aspects of the small group (under 15 in size), but very little is known about medium group dynamics (groups of 20-70 in size). Specifically, there is no empirical evidence on such questions as: (a) the most effective way to subdivide a group of 50, (b) how leadership emerges in a group of this size, (c) the comparative effectiveness of different types of leadership, (d) the effects of mixed versus homogeneous populations on achievement of group goals, and (e) the length of time it takes to establish a cohesive group of 50 persons.

2. Grouping under stress. While there is much descriptive material available on human behavior under stress, there is very little empirical data on the effects of anxiety, fear, deprivation upon the grouping phenomenon. The conditions under which stress unifies and strengethens groups, and under which it divides and weakens them have not been systematically studied.

3. Research on shelter grouping. In addition to the basic research described above there is a great need for empirical investigation of the special requirements and characteristics of a shelter system, in regard to population grouping. This includes, examining the impact upon different forms of groupings of such variables as:

(a) overcrowding
(b) shelter leadership (trained, emergent, competing)
(c) population characteristics, especially children

(d) physical layout of the shelter
(e) length of stay in shelter
(f) lack of communication, or transmission of inaccurate information
(g) planned activities
(h) noise, illumination, atmosphere and temperature conditions
(i) emotional illness

4. Research on non-empirical simulation of shelter systems. It should be clear that there are many facets of the shelter system that are not amenable to empirical investigation. For example, it is highly unlikely that there will ever be habitability data about a shelter of 5 000 people.

Non-empirical simulation, taking such forms as mathematical models, systems analysis, computer simulation will be a source of valuable information that could not otherwise be attained. Further work is necessary to develop and improve such models, and to provide the required data base, without which simulation cannot meet success.

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APPENDIX A

The Grouping Model

1. A TENTATIVE MODEL FOR ANALYSIS OF OPTIMAL POPULATION UNITS IN LARGE SHELTERS

Rationale for Model

The problem is to develop a model which will permit the generation of meaningful, testable, predictions as to optimal sub-grouping in large shelters. Such a model should provide for consideration of a comprehensive range of shelter functions and conditions, or "function - condition" combinations, having varying degrees of criticality and likelihood of occurrence. It is considered desirable to attempt the development of a model possessing a reasonable degree of quantification. The lack of large quantities of relevant precise numerical data, and the difficulties inherent in obtaining such data, suggest that attempts to develop a highly sophisticated mathematical model would, at this time, be premature. However, a model "sufficiently mathematical" to aid the symbolic processing of available data (obtained and extrapolated) in a systematic and logical manner would be highly desirable.

The following model represents an initial attempt in the desired direction. It is only a tentative framework illustrating one possible point of departure. Other approaches will be considered in the course of the present study. If it should be considered desirable to pursue the present approach, it is anticipated that considerable elaboration and refinement would be involved.

Basic Assumptions and Limitations

1. Shelter functions, i.e., activities which must (or should be) carried out in the shelter, will be treated not in isolation but rather in context of the situations or conditions under which they may have to be carried out. Hence, the term "function" will actually imply a "function - condition" combination or interaction.

2. It is assumed that varying the size of the sub-group may affect a given function in at least three ways:

   a. Increase (or decrease) the effectiveness with which the function can be met.
   b. Decrease (or increase) the criticality (consequences) of the function.
   c. Decrease (or increase) the probability or likelihood of occurrence of the function - condition.

3. It is assumed, at least for some functions, that judgments can be made as to the direction and relative magnitude of such effects as noted in (2) above.

4. For purposes of simplification, it is further assumed that these judgments (Cf. 3 above) can be expressed as simple linear relations or, in extreme cases, as sets of two or three simple linear relations.

Definition of Terms

$$(1) \quad E = \sum_{i=1}^{i=n} e_i/c_i p_i$$

Where: E = Estimated effectiveness of shelter operation with respect to all N functions (function - conditions) where these functions have been weighted in terms of criticality and probability of occurrence.

N = Total number of shelter functions (function - condition interactions).

e_i = Estimated effectiveness of shelter operation with respect to the i^{th} function--$[0 \lesssim e_i \lesssim 1]$.

c_i = Estimated criticality of i^{th} function--$[0 \lesssim c_i \lesssim 1]$.

p_i = Estimated probability, or likelihood of occurrence, of i^{th} function (function - condition).

$\hat{e}_i = \frac{e_i}{c_i p_i}$ = Estimated effectiveness of shelter operation with respect to the i^{th} function where this function has been weighted in terms of criticality and probability of occurrence.

(2) $\begin{cases} e_i = m_i X + k_i & \text{(Effectiveness)} \\ c_i = a_i X + b_i & \text{(Criticality)} \\ p_i = u_i X + v_i & \text{(Probability)} \end{cases}$

Note: Curvilinear relations will be expressed as sets of 2 or 3 linear relations.

Where: X = Size of unit or sub-group

m_i, a_i, u_i = Slope constants (empirical/arbitrary)

k_i, b_i, v_i = Intercept constants (empirical/arbitrary)

e_i, c_i, p_i = As defined above.

(3) $c_i p_i = a_i u_i X^2 + (a_i v_i + b_i u_i) X + b_i v_i$

(4) $\hat{e}_i = e_i / c_i p_i = \left[m_i X + k_i \right] \Big/ \left[a_i u_i X^2 + (a_i v_i + b_i u_i) X + b_i v_i \right]$

(5) $E = \sum_{i=1}^{i=n} \hat{e}_i = \sum_{i=1}^{i=n} \frac{e_i}{c_i p_i} = \sum_{i=1}^{i=n} \left[\frac{m_i X + k_i}{a_i u_i X^2 + (a_i v_i + b_i u_i) X + b_i v_i} \right]$

or, equivalently:

$E = \hat{e}_1 + \hat{e}_2 + \hat{e}_3 + \ldots + \hat{e}_n$

$E = \frac{e_1}{c_1 p_1} + \frac{e_2}{c_2 p_2} + \frac{e_3}{c_3 p_3} + \ldots + \frac{e_n}{c_n p_n}$

Capabilities of the Proposed Model

The Present model provides a method for computing:

1. The size, X, of population unit (sub-group) which is optimal in the sense of maximizing the estimated effectiveness of shelter operation with respect to <u>any given function</u> (function - condition) when this function has been weighted in terms of criticality and probability of occurrence.

2. The size, X of population unit (sub-group) which is optimal in the sense of maximizing the effectiveness of shelter operation with respect to <u>all functions</u> (function - conditions) when these functions have been weighted in terms of criticality and probability of occurrence.

3. The size, X of population unit (sub-group) which is optimal in the sense of maximizing the effectiveness of shelter operation with respect to <u>any given sub-set of functions</u> (function - conditions) when these functions have been weighted in terms of criticality and probability of occurrence.

Mechanics of Computing Optimal Sizes

1. To compute the optimal size, X, of population unit with respect to a <u>given function</u>, e.g., the i^{th} function - condition:

   a. Take the first derivative, using standard calculus techniques, of the appropriate weighted effectiveness value:

$$\hat{e}_i' = \frac{d(\hat{e}_i)}{dX} = \frac{d(e_i/c_i p_i)}{dX}$$

$$= \frac{d\left[\dfrac{m_i X + k_i}{a_i u_i X^2 + (a_i v_i + b_i u_i)X + b_i v_i}\right]}{dX}$$

$$= \frac{m_i}{\left[a_i u_i X^2 + (a_i v_i + b_i u_i)X + b_i v_i\right]^2}$$

$$- \frac{\left[m_i X + k_i\right]\left[2a_i u_i X + a_i v_i + b_i u_i\right]}{\left[a_i u_i X^2 + (a_i v_i + b_i u_i)X + b_i v_i\right]^2}$$

b. Set this derivative, $\frac{d(\hat{e}_i)}{dX}$, equal to zero and solve for X.

Note: This solution yields a rather formidable quadratic--formidable in that the "a," "b," and "c" constants of the quadratic involve thirty-seven separate numerical components. Solution on a computer, of course, would be quite simple.

c. Apply first derivative test for maximum, taking higher derivatives if necessary.

2. To compute the optimal size, X, of population unit with respect to all functions (function - conditions):

a. Take first derivative of E:

$$E' = \frac{d(E)}{dX} = \frac{d \sum_{i=1}^{i=n} e_i / c_i p_i}{dX}$$

Note: This boils down to a series of derivatives of the type involved above:

$$\frac{d(E)}{dX} = \frac{d(\hat{e}_i)}{dX} + \frac{d(\hat{e}_2)}{dX} + \frac{d(\hat{e}_3)}{dX} \cdots + \frac{d(\hat{e}_n)}{dX}$$

If the number (N) of function - conditions is large, as seems likely, the use of a computer in obtaining this solution is practically imperative.

b. Set derivative equal to zero and solve for X.

c. Apply first derivative test for maximum, taking higher derivatives if necessary.

3. Similar solutions for optimal size, X, f population unit with respect to any given sub-set of functions (function - conditions) can be obtained in the same manner. Whether or not a computer will be required here, of course, will depend upon the number of functions (function - conditions) included in a sub-set.