

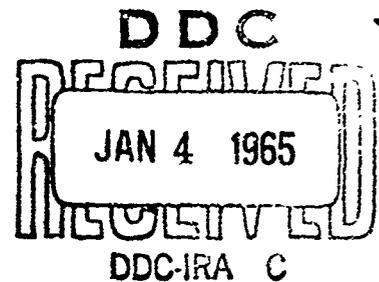
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**STRUCTURAL CHANGE
IN SMALL ISOLATED GROUPS**

PAUL D. NELSON

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**U. S. NAVY MEDICAL
NEUROPSYCHIATRIC RESEARCH UNIT
SAN DIEGO, CALIFORNIA 92152**

BUREAU OF MEDICINE AND SURGERY NAVY DEPARTMENT
WASHINGTON, D.C. 20390

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Structural Change in Small Isolated Groups

by

Paul D. Nelson

Lieutenant, MSC, U. S. Navy

United States Navy Medical Neuropsychiatric Research Unit

San Diego, California 92152

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Abstract¹

Men who had spent twelve months at one of three Antarctic research stations (N ranging from 17 to 33) provided information at two time periods concerning work, formal communication, and off-duty friendship interactions. The purpose of the study was to ascertain the extent to which group structure changed in any of these three domains of interaction over a six-month period. From an analysis of direct, indirect, and reciprocal choices there were no general change patterns common to all station groups or all types of interaction.

During the past decade increased attention has been focused upon problems of human behavior precipitated by stimulus-reduced environments. As suggested by the reviews of Kubzansky (1961) and Vernon (1963), the primary emphasis of such studies has been on the individual in isolation from other individuals. Less frequently studied has been the related, but not identical, problem of the small group operating as a closed system in isolation from other groups or individuals. Just as cognitive and motor functioning are topics of concern in sensory-deprivation studies involving the individual, the problem of group structure, or patterning of interaction tendencies, is of concern in the study of isolated groups.

The implications of group structure for the behavior of individuals in isolated groups have been discussed in studies ranging from prisoner-of-war groups (Schein, Schneier, & Barker, 1961) to Arctic station groups (Braun & Sells, 1962). Among the studies in which attention has been focused specifically upon changes in group structure, Altman, Smith, Meyers, McKenna, and Bryson (1960) observed groups confined to civil defense shelters, Seaton (1962) evaluated small Arctic traverse parties, and Torrance (1957) reviewed a series of studies of small military groups undergoing survival training. Although diverse in their settings, these studies suggest several hypotheses about group structure.

When faced with the stressful demands of an unknown environment, men attempt to provide some stable social structure. Changes in such structure tend to be a function of changing needs within the group or of the inability for an already existing structure to cope with current needs. Over time there is a tendency within isolated groups for formal authority structures to be less tolerated, for group structure to become less complex, and, while intimacy increases, for general interpersonal concern to diminish. It should be noted, nevertheless, that differences between groups have been observed in each of these studies just as one finds differences in response patterns among individuals in studies of sensory-deprivation.

¹An abbreviated form of this paper was presented at the Annual Meeting of The American Psychological Association, Los Angeles, California, September 1964.

Most of the studies of structural change in isolated groups have involved time intervals of days or weeks and group members who are, at least initially, without a variety of formal roles. One setting in which the isolation is of a longer duration and in which formal roles exist from the onset of group experience is that involving small groups confined for twelve continuous months to remote research stations on the Antarctic continent. Composed of Navy personnel who are responsible for the maintenance and operation of the station and of civilian scientific personnel responsible for the research programs of the station, the groups must adapt to the problems of two general time periods. During the first six summer months, there is nearly continuous sunlight, much of the work is carried out out of doors, and there are periodic visits by persons not included in the station membership. Once the six winter months set in, the darkness and climatic conditions require activities to be performed almost exclusively indoors, and, except for occasional radio communication, the station members have no contact with the outside world. There is a closed group, restricted physically and socially.

In previous studies of Antarctic station groups (Gunderson & Nelson, 1962 & 1963), attitudes of the men relevant to group compatibility, teamwork, and efficiency were observed to deteriorate from summer to winter. As in other studies, station differences existed in the extent to which attitude change occurred and with regard to the favorability of attitudes at any one time. The extent to which changes occur in actual patterns of interaction has not, however, been studied among these station groups. The present study, in an effort to evaluate such interaction patterns, was oriented towards three general classes of interaction: day-to-day work interaction, formal communication patterns, and off-duty or leisure time friendships. Comparisons were made of group structures for summer and winter periods within each of these domains of interaction.

Method

Subjects. The members of three Antarctic station groups (N's of 33, 22, and 17 men) served as subjects in the present study. Each of these individuals spent twelve months at their respective stations. At each station there were a few additional men who were not included in the study since they were not an integral part of the station membership for the total twelve-month period. Across the three stations there were 23 Navy construction personnel, 9 Navy radio communications personnel, 17 Navy and civilian weather observer personnel, and 14 civilian scientific research (physics) personnel. Each station had one Navy officer-in-charge, one Navy cook, and one Navy hospital corpsman. The average age for all station personnel was approximately 27 years with a range of from 18 to 43. Characteristic educational levels were 12 years

for Navy enlisted personnel, 15 years for civilian weather observer personnel, and 17 years for civilian science research personnel. Complete data were obtained from all but seven of the 72 men.

Procedures. At the end of the first six months (Summer) and again at the end of the last six months (Winter) the men at each station independently completed a job description questionnaire. On this questionnaire were several questions of a sociometric nature which served as sources of data for the present study. These questions, in the order by which they relate to various domains of interaction and not necessarily in the order by which they appeared on the questionnaire are as follow:

1. Work interaction

- a) During the past few months what person or persons have worked directly with you in carrying out the tasks of your occupation?
- b) During the past few months, what person or persons have come to you frequently for advice on problems which are related to your occupation?
- c) During the past few months, if you needed occasional advice on your problems, which person or persons did you generally consult?

2. Formal communications

- a) If you wanted complete up to date information about military problems whom would you talk with first?
- b) If you wanted complete up to date information about logistics problems (related to station operations) whom would you talk with first?
- c) If you wanted complete up to date information about problems and progress of the scientific mission whom would you talk with first?

3. Off-duty friendship

- a) On an average day during the past few months, including work and off hours, what person or persons, if any, do you generally spend most time with? (Off-duty friendship choices were considered to be those choices on the preceding question with whom the choosing individual did not also have work interaction.)

A choice made on any of the three work interaction questions was considered indicative of work choice and, likewise, a choice made on any of the three questions pertaining to formal communications was considered indicative of interaction within that domain. A station sociometric data matrix was constructed for each of the three domains of interaction for each of the two time periods. Each individual within a given matrix either did or did not choose each of the other group members. These data were then analyzed for frequencies of direct (one-step) choices (D), reciprocated direct choices (R), and indirect (two-step) choices -- excluding persons chosen directly (I). A direct choice is an actual person to person choice, such as in X choosing Y; an indirect choice is one made through a direct choice, such as X to Y to Z, X to Z being the indirect choice. Reciprocal and indirect choices provide information about the complexity of

of group structure.

Results²

The average number of sociometric choices made within time period in the three areas of work, communications, and off-duty friendship interaction are shown in Table 1. Although no statistical tests were applied to these data some general patterns can be noted. The greatest average number of interpersonal relationships is found within the context of work interaction. The smallest average number of relationships exists for the off-duty friendships. Two factors may account for the latter finding, in addition to the fact that probably less time per day is spent in off-duty activity. First, to the question "With whom do you spend most time on an average day," over 50% of the individuals named were persons with whom the chooser worked; the off-duty friendship choice, by definition, did not include work partners. This tendency for the greatest proportion of one's closest associates to be one's work partners was more apparent for the smallest than for the largest station although station differences within time period were insignificant ($p > .20$) when tested for homogeneity among several proportions (Wallis, 1956). A second factor accounting for the small number of off-duty friendship choices was that many individuals indicated that, aside from a few work partners, they spent no more time with one man than with another, suggesting an absence of specific social structure during leisure time.

Another observation in Table 1 is that the number of indirect choices approximately equals the number of direct choices in work interaction and off-duty friendship. At the same time, relatively few of the direct choices are reciprocated, the greatest percentage of reciprocations occurring among work interaction choices. This suggests the possibility that individuals have varying frames of reference regarding the persons with whom they most frequently work or spend their leisure time. For example, while Person X may feel he has most of his work interaction with Person Y, the latter may feel that he has most of his work interaction with Person Z. The result is a relatively complex structure in which many group members are linked through different degrees of interaction. The almost complete absence of reciprocated choices in formal communications suggests the existence of one-way channels in that domain of interaction. The officers-in-charge and senior science personnel, who received most of the choices on formal communications, generally indicated that they went outside the station (by radio) if they needed information not immediately available to them. This represents the operation of a chain of command usually found in formal organizations.

²All tables referred to in this section can be found in the Appendices A, B, C, and D, respectively.

A third major trend in the results of Table 1 is that the number of choices during winter appears to be somewhat less than the number made during the summer period. To test for significance of change in numbers of choices made from summer to winter, the sign test was applied to individual choice frequency scores made during the two time periods within each type of interaction. That is, for every individual a determination was made as to whether he had more, the same, or fewer choices in the summer than in the winter for any given type of interaction. Results, in the form of statistical levels of significance resulting from such comparisons, are found in Table 2. Under the null hypothesis, one would expect the numbers of choices to be comparable for the two time periods or for the tendency of more choices in summer to be no greater than the tendency of more choices in the winter. No overall pattern was revealed. Results varied by station group, type of interaction, and complexity of interaction (direct, indirect, and reciprocal choices). For example, the number of work relationships tended to diminish at two stations while the off-duty friendship relationships increased in number at the third station. Furthermore, a change in direct relationships was not necessarily accompanied by a change in the indirect relationships.

As a supplement to the preceding analyses of choices made by station members, evaluation was made of the distributions of direct choices received by individuals for the two time periods. These data are shown in Table 3. Fewest isolates, individuals receiving no choices, are as might be expected in the domain of work interaction; correspondingly, the type of interaction in which most group members do not receive choices is that of formal communications. The percentage of isolates in off-duty friendship relations increases as group size decreases; it will be recalled that in the smaller station proportionately more of the off-duty interactions involve persons who also have work interaction. Greatest changes in distributions from summer to winter, as ascertained by testing proportions for matched samples (Wallis, 1956), were found in the largest of the three stations. In work interaction the number of persons receiving at least three choices diminished over time ($p < .05$) while in the area of formal communications the number of persons receiving at least one choice increased over time ($p < .20$).

One final analysis was that of evaluating the total choice patterns for all individuals. This was a determination of the extent to which individuals interacted with the same persons during the two time periods. The fact that somewhat more choices were made during the summer than during the winter does not in itself indicate identities of choice. The data were therefore analyzed in terms of the percentages of station members whose summer and winter choices in each area of interaction were at least 50% identical. The results are shown in Table 4. The

most stable structures in terms of choice patterns were those denoting work interaction and formal channels of communication. Applying to these data the χ^2 test for homogeneity among several proportions (Wallis, 1956), the stations were appreciably different in stability of structure ($p < .05$) only on formal communications, stability being negatively related to station size. While in most cases more than half the group members had at least 50% overlap in work and communications choices, less than 10% had such overlap in choices of off-duty friends. The latter result may be partially accounted for by the relatively small number of such choices that were made.

Discussion

The analysis of work, formal communications, and off-duty friendship structures at three small Antarctic research stations revealed no clear-cut pattern of change over a six-month period. While there was perhaps a tendency for more interaction relationships to exist during the summer period than during the winter, the extent to which such differences departed from chance was a function of both station group and type of interaction. The complexity of structures, as indicated by indirect choices made, did not systematically diminish for all stations or types of interaction. In terms of specific individuals or subgroups involved in interaction, there appeared to be more stability over time in task-oriented than in social-oriented structures.

Certainly the total context within which the group operates must be considered in detail when attempting to understand structural patterns and change within groups. Seaton's (1962) groups were smaller than the present groups, had perhaps less complex a mission orientation, were experimentally manipulated on food intake during their operation, and were observed more intimately over shorter time spans than were the present groups. Torrance's (1957) groups were also smaller in size, less complex in mission orientation, observed over shorter periods of time, and were exposed to varying degrees of emergency situations with which the group had to cope.

As the needs and roles of group members vary over time, it seems likely that structural changes will occur within isolated groups in much the same way as they might in non-isolated groups. The major problem facing the isolated group is that it must re-structure from the same population of individuals. For the present station groups, the larger parent organizations from which station members come and to whom they are ultimately responsible for their work undoubtedly supply a source of sanction operating against the deterioration of work structures. Also, the possibility of gross changes in task-oriented structures is somewhat reduced by the

minimal overlap in task roles resulting from the diverse and highly technical occupational specialties found at these stations. Thus, the men tend to preserve work structures within specific occupational areas.

In terms of personal friendships there is greater opportunity for variation in structure over time, particularly as group size increases. Actually, the six-month time span used in the present study may have been insensitive to greater variations in friendship patterns than were actually observed. If, as was hypothesized earlier in this paper, intimacy in interpersonal relations increases rapidly in isolated groups, one might expect proportionately more frequent changes in friendship structures on the assumption that as one individual knows in greater detail the values and background of another individual the relationship becomes either more solidified or terminates through incompatibility. It may very well be that if the potential consequences of strong personal friendships are anticipated men in the present type of situation avoid establishing highly structured social patterns. There is some indication from the present data that off-duty friendships are not highly structured.

In further studies of this problem, replications of group sizes would be desirable since size is such an important parameter of group structure. Closer attention to role complexity would also be of value in understanding structural change or stability. The extent to which a parent organization or outside referent group provides a source of reward or sanction for behavior outcomes of an isolated group might furthermore be related to structural patterns within the group. Finally, further attention should be given to the sampling of structures over time as well as the concomitant sampling of situations or critical events which test the adequacy of existing structures.

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Appendix A

Table 1

Average Numbers of Sociometric Choices Made per Person for Two Time Periods Within Three Station Groups

Types of Choice/ Time Periods	Groups ^a					
	Station A (N = 33)		Station B (N = 22)		Station C (N = 17)	
	<u>Summer</u>	<u>Winter</u>	<u>Summer</u>	<u>Winter</u>	<u>Summer</u>	<u>Winter</u>
<u>Work Interaction</u>						
Direct choices	4.1	2.7	3.6	3.2	3.5	2.8
Reciprocal choices	2.0	1.3	1.1	1.8	1.8	2.1
Indirect choices	4.2	2.4	3.6	3.0	3.3	1.6
<u>Sources of Formal Communications</u>						
Direct choices	2.8	2.4	1.8	1.4	2.3	2.3
Reciprocal choices	0.3	0.3	0.0	0.0	0.0	0.0
Indirect choices	3.6	3.1	0.1	0.1	0.4	0.4
<u>Friendship Choices Off-Duty</u>						
Direct choices	1.1	1.1	0.6	1.2	0.8	0.8
Reciprocal choices	0.2	0.3	0.0	0.3	0.2	0.0
Indirect choices	1.1	1.2	0.0	0.8	0.6	0.0

^aStation sizes (N) represent the number of members in the group; the actual numbers of group members providing data for this Table were: N = 32 for Station A, N = 20 for Station B, and N = 13 for Station C.

Appendix B

Table 2

Results of Sign Tests Applied to Differences in Numbers of Sociometric Choice Made for Summer and Winter Periods by Individuals of Three Station Groups^a

Groups ^c	Types of Interaction ^b											
	Work Interaction			Formal Communications			Off-Duty Friendships					
	D	I	T	R	D	I	T	R	D	I	T	R
Station A (N = 32)	S > W (.05)			S > W (.05)	S > W (.20)							
Station B (N = 20)					S > W (.20)							
Station C (N = 13)	S > W (.20)	S > W (.05)	S > W (.05)			S > W (.10)			W > S (.20)	W > S (.10)	W > S (.10)	W > S (.20)

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^a The symbol S > W indicates more choices made in summer than in winter; the symbol W > S indicates more choices made in winter than in summer. The preceding symbols are accompanied by the statistical level of significance associated with the difference for all results in which $p \leq .20$.

^b D: Direct sociometric choices made
 I: Indirect sociometric choices made (exclusive of direct choices)
 T: Direct plus indirect choices made
 R: Direct choices reciprocated by individuals chosen.

^c Station sizes (N) refer to numbers of station members from whom these data were obtained.

Appendix C

Table 3

Percentages of Group Members Receiving Various
Numbers of Direct Choices in Three Types of Interaction

Type of Interaction	Numbers of Choices Received	<u>Groups</u>					
		Station A (N = 33)		Station B (N = 22)		Station C (N = 17)	
		<u>Summer</u>	<u>Winter</u>	<u>Summer</u>	<u>Winter</u>	<u>Summer</u>	<u>Winter</u>
Work	0	3%	6%	0%	4%	12%	18%
	1 - 2	27	45	32	32	47	47
	≥ 3	70	49	68	64	41	35
Formal Communications	0	67%	52%	77%	82%	65%	71%
	1 - 2	6	21	9	9	12	6
	≥ 3	27	27	14	9	23	23
Off-Duty Friendship	0	36%	30%	54%	36%	59%	71%
	1 - 2	52	64	45	54	35	24
	≥ 3	12	6	0	9	6	6

Appendix D

Table 4

Percentages of Individuals in Three Station Groups Having at Least Fifty Percent Identical Sociometric Choices for Summer and Winter Periods for Three Types of Interaction

<u>Groups</u> ^a	<u>Types of Interaction</u>		
	<u>Work Interaction</u>	<u>Formal Communications</u>	<u>Off-Duty Friendship</u>
Station A (N = 32)	59%	50%	06%
Station B (N = 20)	45%	65%	05%
Station C (N = 13)	62%	85%	08%

^aStation sizes (N) refer to numbers of station members from whom these data were obtained.