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ORGANIZATIONS AS COMMUNICATION STRUCTURES:

AN EMPIRICAL-THEORETICAL APPROACH

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# Abstract

A research program concerned with organizational communication is discussed.  The conceptual basis used in this program to examine communication process and structure is reported and data are provided which describe communication content derived aspects of organizational structure.  The data suggest that viewing organizations in communication content terms may be more beneficial to understanding some other organizational processes than are some more frequently used descriptions, such as formal authority charts.  Hypotheses concerning possible antecedents and consequences of different communication structural phenomena are mentioned.

## ORGANIZATIONS AS COMMUNICATION STRUCTURES:

## AN EMPIRICAL-THEORETICAL APPROACH

While almost every organizational writer mentions the importance of communication and some even state that without communication there can be no organization (Barnard, 1938; Simon, 1957) researchers and theorists alike tend not to focus in depth on communication aspects of organizations. Yet, detailing communication activities may be an important mechanism for describing organizations as systems. Because communication is manifest by individuals, groups, and total organizations, it is a concept which might be basic to describing organizational functioning. Unlike descriptions based on organizational size, functional specialization, technology, formal charts, etc., the concept of communication ultimately allows the dynamics of organizational life to be observed.

The global concept of "organizational communication" has not yet been unfolded nor its facets explored. When communication facets are identified relationships among them can be examined as can relationships among communication and other aspects of organizations such as individual performance, attitudes, and decision-making; group functioning; organizational coordination; etc. From this work should come rather complete descriptive pictures of different kinds of organizations, and models which might later be used to predict different sets of responses of interest to researchers and practitioners. From a practical standpoint communication is of obvious importance because organizational participants spend so much of their time doing it and because no other organizational activities can happen without it.

If organizational communication is both theoretically and prac-
tically important why is there so little research in the area (Guetzkow,
1965; Porter & Roberts, 1975; Roberts, O'Reilly, Bretton & Porter,
1974; Thayer, 1965; etc.)? One reason is because of the difficulties
involved in extricating communication behaviors and perceptions about
communication from other organizational activities. This problem
directly results from the lack of attention given to defining facets
of the phrase "organizational communication." What research does
exist generally lacks in innovation. This may be because the task
of unravelling global concepts is dull and tedious. It may also be
because researchers have generally accepted an overly simple model
of the communication process which merely states that senders encode and
send (perhaps through noisy channels) messages which are decoded by
receivers and are frequently misinterpreted (Shannon & Weaver, 1949).
There exist no frameworks or models which help integrate what is
known and which can suggest the content of future research which
will fill the gaps most beneficially.

To be appropriate a framework which guides investigations in
organizational communication must recognize that organizations are
composed of sub-assemblies, which respond to their environments, and
which can be grafted onto or severed from organizations. Simon (1962)
proposes that such sub-assemblies are rather stable. Weick (in press),
however, discusses circumstances in which general instability or
looseness of coupling within or between sub-assemblies may be crucial
to an organization's existence. Weick further proposes that by its
very nature organizational research is likely to uncover only tight
coupling among elements, but that research strategies which have

potential for uncovering and examining weak coupling should be developed. Tight couplings within and between organizations must obviously be identified before the more subtle loose couplings can be found.

One purpose of the research program of which this is an overall description was to find and adopt a general framework to guide research in organizational communication, research relevant to several of the conceptual and observational levels of interest to organizational researchers (individual, group, and organizational). A second purpose is to begin to identify communication variables within each observational level which might be inter-related ultimately and then related to other important organizational behaviors within each level. Across level relationships might then be explored profitably.

This paper describes the framework adopted, identifies communication facets found at each level, and shows relationships among them. Based on initial findings, within level hypotheses for future research are provided. Subsequent papers (Roberts & O'Reilly, 1975; O'Reilly & Roberts, 1975b) look closely at relationships of individual communication phenomena to other individual characteristics and at group communication facets and other group characteristics.

BOOTSTRAPPING A FRAMEWORK FROM WHICH TO PROCEED IN ORGANIZATIONAL COMMUNICATION RESEARCH

A framework, in its simplest form, is a set of specifications which tells where to look for variables of interest and suggests other variables which might modify variables of primary interest to researchers. The general strategies provided by Dubin (1969), Kerlinger (1972), Lazarsfeld and Menzel (1969), etc., are consistent with a systems

theoretic view of organizations (Bertalanffy, 1962; Buckley, 1967;
1968; Churchman, 1968; etc.) as is the terminology used here and
borrowed from Roberts and Hulin (1974): $R = f(U.E, UxE)$. $R$ is a
vector of behaviors, attitudes, and other kinds of responses. $U$s
are sets of characteristics of responding units (and must be reflected
at the same analytic level as Rs). Units and their responses can
be entities other than individuals, they may be aggregates of indi-
viduals, etc. For example, friendliness is usually thought to be
an individual response, while cohesiveness is a group phenomenon.
$E$s are sets of environmental or setting characteristics which may or
may not influence responses through their impact on characteristics
of responding units. If responses of interest are made by individuals,
setting characteristics are group phenomena. If group responses are
of primary interest the setting is some larger entity. Ultimately
the results of complementary research designed within each of the
several analytic levels, but taking into consideration the setting
characteristics of the next macro level, can be tied together. Most
organizational behavioral research implies a strategy such as this
one in the interest of identifying relationships at different observa-
tional levels which, when tied together, will contribute to theory.
Almost no research programs, however, follow such a dictum, resulting
in the inability to integrate findings from researchers with different
analytic perspectives about similar problems.

Research designed according to the simple formulation detailed
here is reported in Herman, Dunham, and Hulin (1975) and by O'Reilly
and Roberts (in press, b). One important notion about organizations as
open systems is not addressed explicitly in this formulation (or in

research reported to date derived from it). Responses at time one may

change the setting at time two. Consequently, time two's setting may

change units in these settings and even change their responses. The

research reported here takes this into consideration by looking at

stability and change over time.

Keeping in mind systems theorists pleas for inclusive investi-

gations of reciprocal relationships at the same and across different

conceptual levels, two criteria (Katz & Kahn, 1966, p. 18) were used

in specifying social systems; (1) tracing consistent patterns of energy

exchange, and (2) ascertaining how the output of a system is transmitted

into enery which reactivates the system. These criteria are concep-

tualized by O'Reilly (1975) as corresponding in organization information

processing terms to communication structures (the recurring patterns

of interactions which map individuals in organizations into groups

and groups into networks), and communication processes (phenomena

associated with the process of information transmission and reception,

inferred meaning, etc.). Antecedents to structure-process relation-

ships are also in need of definition. The general approach briefly

described here and the research emanating from it follow Cattell's

(1966) inductive-hypothetico-deductive spiral in which some initially

observed organizational regularities are used to guide decisions about

what other kinds of data to collect.

FURTHER BOOTSTRAPPING

A considerable amount of initial work in this programmatic

research was devoted to explicating elements of the communication

process as it is engaged by individuals in organizations (Roberts &

O'Reilly, 1974b). Through a series of laboratory and field investigations relationships among communication facets were explored, and relationships of communication processes or responses, characteristics of individuals, and other work relevant response were examined. For example, Roberts and O'Reilly (1974b) identified and assessed thirteen dimensions of people's perceptions about their work related communications and related these dimensions to such other individual responses as credibility of the information source (O'Reilly & Roberts, in press a), trust in superior and supervisory influence (O'Reilly & Roberts, 1974; Roberts & O'Reilly, 1974a), job satisfaction and organizational climate (Roberts & O'Reilly, 1974b), and job performance (O'Reilly & Roberts, submitted for publication).

Looking back to our framework, and the criteria adopted for specifying social systems it was now necessary to define communication structures which might later be related to processes; such as perceptions about communication dysfunctions; the relationships of those perceptions to other responses such as job satisfaction and performance; and the relationship of communication processes to characteristics people bring with them to their jobs, such as personality, etc. It was also necessary to examine shifts and stabilities in structure over time in order to identify organizational regularities and dynamics. While we began by attempting to extricate communication perceptions from associated phenomena at the individual level, it was felt that communication structures should be identified at the individual, group, and organizational levels, before returning to each level to investigate relationships of structures to antecedents and to process responses.

IDENTIFICATION OF COMMUNICATION RELATED ORGANIZATIONAL STRUCTURAL VARIABLES

The sociometric literature suggests a large number of communication concepts which can be used to map the structures of organizations at various analytic levels of concern to organizational researchers. Reviews of the large body of relevant studies are available in Lindzey and Byrne (1968), Richards (1974c), and Richards and Lindsey (1974).

From this literature it is clear that individuals in organizations occupy various communication roles in specific communication networks depending on their interaction patterns with others. According to organizational theorists people in organizations are generally in contact with others about at least task (knowledge, information, or "how to do it") issues, about social issues, and about formal authority relationships. The amount and nature of interactions define communication roles people occupy. They can be isolates from interaction regardless of content, or they can talk to a few or many others in their organizations. Participation can be subdivided to examine individuals who specifically link networks together as opposed to those who do not.

There exists little research which describes job relevant correlates of differential individual communication role occupancy in organizations. Clearly, individuals might occupy different roles depending on the content of their interactions. For example, one might be a group member in his social network and an isolate in an expertise or task network. Or he may be an isolate at one time and a participant at another time in the same content based network.

Groups are most frequently described in terms of their size and

the degree in which they are internally connected in the sociometric and small group literature.  In the organizational literature there exists no description of differential size and connectedness of communication groups which develop for different content reasons.  There is no reason to think, for example, that groups engaged in contact about social matters should be larger or smaller than those engaged in contact about formal authority issues.  Nor do we know whether these communication group phenomena represent organizational regularities.  In terms of a multi-level research approach group structural characteristics are setting characteristics for individuals.

Groups, too, exist in environments.  The sociometric literature suggests these environments can be thought of as networks and a few obvious properties of networks are the number of groups which comprise them and the degree and manner in which these groups are connected to one another.  For various content defined (social, expertise, and formal authority) networks, it seems necessary to identify similarities and differences in these more macro environmental characteristics and to examine again whether such characteristics represent regularities in organizational life.  One characteristic of group interconnectedness that has not been explored is the degree to which groups in various content defined networks are sharply or narrowly delineated from one another.

In review, then, the attempt here was to identify a manageable number of communication relevant individual level characteristics (role participation or isolation), setting characteristics one conceptual level of analysis removed (communication group size and connectedness), and environmental characteristics one further level of analysis removed (network size and connectedness).  These characteristics were observed for the three most frequent types

of content interaction organizational theorists report occur in work organizations (expertise, social, and authority). After the structural phenomena were identified their stability over time was assessed in order to ascertain whether they represent organizational regularities. Hypotheses were derived which might explain the findings and which should be tested in future research.

METHOD

Subjects

The respondents were officers and enlisted personnel in three high technology military units. They were assessed three months after the units were commissioned and again one year later. During this interval the organizations grew considerably (from over 500 to over 800 personnel). An 81% response rate of all squadron personnel on base was obtained at each assessment.

Procedure

Respondents twice completed a survey containing three sociometric questions. The first question, "when you need technical advice in doing your job who are the persons you are most likely to ask" provided information identifying expertise network facets. The question "with which persons in this squadron are you most likely to have social conversations (not work related) in the course of a work day" was used to elicit informal or social network facets. And, "if you are upset about something related to the Navy or to your job, to whom in the squadron are you most likely to express your dissatisfaction (gripe) formally" was meant to assess the formal authority structures of the organizations.

Respondents provided the name or description (later turned into a name) of relevant persons appropriate to each question and indicated the frequency and importance of each contact with them.

This data collection device is hampered by some difficulties. People frequently limit their responses in any free recall situation. In new organizations there is the possibility that they will name contacts tangential to but not in their organizations (for example, technical representatives from other companies). Better responses might be elicited to each question if individuals had before them rosters of all personnel in their organizations. In large organizations, however, provision of such rosters is impossible and may not be very helpful because of the time required to scan them.

Brief attention is given the analytic technique used here because of the novelty in the literature of investigations which apply large scale sociometric techniques to complex organizations. Farace, Richards, Monge, and Jacobsen (1973) comment on the fact that sociograms, matrix manipulation and multi-dimensional scaling methods have all been used to render social choice data interpretable. "These approaches...do not seem to offer a way to uniquely designate the participants in various communication roles. This problem, plus the constraints placed on them by limitations in /the size of the data base/, seriously hampers their usefulness in large social systems (p. 10)."

Richards (1974a; 1974b; 1974c) has developed a vector solution technique which he states provides a systematic procedure for identifying role occupants, drawing group boundaries, locating inter-group

connectedness, etc; for networks composed or large numbers of individuals.
Specific network roles are explicated in terms meaningful relative to
the existing sociometric literature and the technique is relatively
economical. A pattern recognition algorithm is applied to the results
of an iteration operation which treats each relationship between a
pair of people as a vector. Vectors have two aspects, direction and
magnitude. Direction is a nominal variable (the contactee), and the
magnitude is the strength of the relationship (in this case frequency
multiplied by importance of the interaction). From a tentative
description of a system more exact descriptions are developed by
applying the criteria for identifying different kinds of participants
(Richards, 1974b). Application of the methodology in complex organi-
zations is described by Berlo, Farace, Monge, Betty, and Danowsky
(1972); MacDonald and Farace (1972); and Monge and Lindsey (1974).

In essence the method identifies for any specific communication
content:

I.  Groups or sets of people who talk to each other more than
    to people outside their groups.

    A.  Non-participants are either not connected or are minimally
        connected to the rest of the network (isolates).

    B.  Participants are people with two or more links to other
        participants. In most cases these people comprise the
        bulk of the network and allow structure to develop.

        1.  A person is a member of a group if over fifty percent
            of his communications are with people in that group.

        2.  A person is a liaison if most of his communications are

with group members in general but not with members of
one group, and if he has at least three contacts.  He
is a <u>bridge</u> if he belongs to a group but talks to at
least one person in another group.  Bridges and liaisons
when combined are called <u>linkers</u>.

3.  A person is an <u>other</u> if he has two or more links to
other participant nodes but fails to meet the fifty
percent criterion.

## RESULTS

### Individual Properties of Networks

Table 1 provides descriptive data concerned with the proportion
of individuals who are participants and who are isolates in each kind of
communication content derived network.  There is considerably greater
similarity in the distribution of role occupancy both at one point in
time and across time in social and expertise networks than in either of
these kinds of networks and authority networks.  While role occupancy
in all three network types is surprisingly stable over time, there is
less stability in authority networks than in the other two types.  That
is, the degree to which specific individuals continue to occupy the
same communication roles remains fairly stable over time.  In general,
over time and as organizations grow, of the people who stay in the
organizations more isolates become participants than participants become
isolates.  For example, in the expertise networks thirty four percent
of the isolates at time one remain isolates at time two, while sixty
six percent of the isolates at time one become participants at time two.

In the same networks eighty one percent of the participants at time one remain participants at time two, while nineteen percent become isolates. A reasonably similar picture exists for the social networks but not for the authority networks.

Table 1 about here

When looking at Table 1 bear in mind a limitation placed on analyzing sociometric data obtained from new and growing organizations. At time one organizational members named 800 others as contacts in the three networks. Yet many of these 800 were actually outside the organizations assessed. Some respondents named inside organizational contacts from whom it was not possible to obtain responses. At time two the 700 contacts mentioned across the three networks are primarily people in the three organizations assessed. Since the organizations grew considerably the fact that a greater percentage of people are generally shown to participate at time one than at time two may be an artifact of collecting sociometric data in these kinds of organizations. Table 1 illuminates what happens to people in the organizations at both times one and two only through the stability information provided.

Linkers (bridges and liaisons) were examined apart from other participants. There are sixty eight (8.5%) linkers in the expertise networks at time one, forty one (5.1%) in the social networks, and 4 (0.5%) in the authority networks. At time two there are 169 (23.3%) linkers in the expertise, 148 (20.4%) in the social, and 86 (11.8%) in the authority networks. Reasonably, more people participate in general communication activities in their organizations than serve to link parts of those organizations together. There are fewer linkers in authority

networks than in the other two kinds of networks. Possible reasons for this will become clear when we examine group phenomena across networks.

Table 2 shows the degree to which individuals remain in their specific roles across networks at the two points in time. Individuals in the expertise network, for example, are likely to occupy the same roles (isolate or participant) in the other two kinds of networks. Isolates in one network are likely to be isolates in the others. There is slightly less overlap in authority network role occupancy and occupancy in the other two networks than there is in expertise and social network role occupancy. This is a result of the large number of isolates in the authority network and the comparatively large number of participants in the other two networks. Participant-isolate over-lap across networks changes little over time.

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### Table 2 about here
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Group Properties of Networks

Table 3 primarily shows communication characteristics thought to be representative of groups. However, it begins by showing the number of group members (an individual characteristic) in each kind of network so that group characteristics can be examined in relation to changes in individual membership over time. Recall, there are participants in communication networks who are not group members. There are fewer groups (at either time) in authority networks and fewer members in each authority group. The number of groups, and the number of members in each group, are greatest for expertise networks. Note, though, that in both expertise and social networks group size seems to

stabilize at about ten members. Clearly, over time, as the organizations grow larger, the number of groups in them grows dramatically, but not the number of members in each group. This characteristic is true regardless of the communication content derived network type one examines.

From both the individual and group level data the picture is increasingly clear that the nature of authority relationships is different from the nature of expertise and social relationships. Returning to our previous examination of linkers, the fewer groups in the authority networks as opposed to the other networks necessitate fewer linkers. While overall the organizations grew over time their authority networks neither began with as many members or groups as did the other two networks (explaining the larger number of isolates in authority networks) nor did they grow to include as many groups. However, as the organizations grew the number of groups in authority networks grew more dramatically than in the other two networks.

Connectedness in Table 3 is assessed for each group by dividing the number of direct links in the group by the number of total possible links. While the differences are slight, the data do suggest that larger groups are less internally connected than are smaller groups. These data will be discussed in relation to the finding that group size also appears to stabilize regardless of the content network.

Table 3 about here

Network Properties

Table 4 presents data concerned with how groups are linked to form networks or organizations. In examining the data in Table 4 it

should again be kept in mind that bridges are group members and liaisons are not. In all three networks the number of bridges is substantially greater than is the number of liaisons. Yet the number of contacts made by liaisons and the number of contacts made by bridges, both reflections of the amount of work required to tie sub-assemblies into organizations, are remarkably similar to one another and remain so over time. When one divides the number of linking contacts (Table 4), that is bridges and liaisons, by the number of linkers it is found that in expertise networks linkers have the most contacts while in authority networks they are least active. Early in the organizations histories there are very few linking contacts among groups in authority networks, and the number never becomes as high as it does in the other networks. This is understandable in light of the generally smaller size of the authority networks.

As the organizations grow linking activities increase considerably. The ratio of the total number of linking activities to the number of groups is an index of network connectedness (Table 4). It indicates how close groups are to one another. The index formed by dividing the ratio of number of links to number of groups by number of group members is simply another way to estimate integration within networks. Both of these indices show that over time the networks become more integrated. As these organizations grow larger and exist over time there seems to be increasing necessity for integration if communication relevant activities are to be carried out. The degree to which network integration is more attributable to size or longevity cannot be ascertained from these data.

Table 4 about here

DISCUSSION

As indicated previously one of the first steps in the development of

relevant hypotheses in any under-researched area of organizational behavior

is identification of behavioral regularities at different conceptual

levels. Attempts should next be made to identify antecedents and out-

comes at the same conceptual level. To the extent possible, discussion

of the results obtained here by describing organizations as they exist

over time from a communication perspective will maintain separation of

individual, group, and organizational communication structure characteristics.

Individual Properties of Networks

While it is intuitive that people communicate a great deal in work

settings about all manner of things, these findings are, nevertheless,

counter to some other research results. The evidence reported here

suggests that people assume participant (including linker) and isolate

roles and maintain these roles over a relatively long time. Yet, the

innovation diffusion literature (Rogers & Shoemaker, 1971) suggests that

at least linkers (who have some characteristics in common with opinion

leaders) are different individuals at different times. Davis' (1953)

examination of "the grapevine" supports this notion, though Sutton

and Porter's (1968) grapevine investigation does not.

While the data overwhelmingly support the notion of the stability of

role occupancy it would be potentially valuable to examine those indi-

viduals who change roles in one or more networks over time. The data

show that role change is most likely to occur in authority networks. This
may be because of the need to designate new authority relationships in
growing organizations. Or it may reflect the tendency for people to come
to understand their own and others positions in authority networks more
slowly than in expertise and social networks. Another potentially
interesting aspect of role change has to do with whether people are more
apt to move from participation to isolation or vice versa. Our data
suggest that while movement over time from isolate to participant is
more prevalent, a considerable number of individuals move from partici-
pation to isolation. Correlates of role change will be considered in
future research. The specific influences of time (distinct from changes
in size, etc.) on organizational development is suggested by these data
to be an important area for future investigation.

The general question of why individuals change or do not change
roles in various networks suggests the need to examine antecedents of
role occupancy. Some antecedents, no doubt, are determined by the environ-
ments in which individuals work. However, others are likely to be
characteristics of the individuals themselves. One possibility is
that people with particular personality or motivational characteristics
tend to occupy particular roles. For example, people with considerable
self-assurance, or who have high needs for status, may be more apt to
participate than to isolate themselves from communications at work.
Another possibility is that an individual's education leads to parti-
cipation, particularly in expertise related communication. Certainly
rank or status in one's organizations might be more apt to contribute
to participation in authority than in social communication. Finally,

certain personality, motivational, and demographic characteristics may differentially predict role stability over time.

The fact that people do occupy specific communication roles over relatively long periods suggests that these roles may determine or at least be correlated with other job relevant behaviors and with attitudes. Consonant with the small group network experimental findings we expect isolates to be less satisfied than participants with their jobs. Linkers are possibly more satisfied than are other participants because they are potentially information gatekeepers, or they may become linkers because of high job satisfaction.

Due to the increased availability of information, participant job performance may be better than isolate performance, but this notion is hypothesized to be true only for occupants of information dependent jobs. Participants and isolates may well differentially perceive aspects of communication in their organizations such as the degree to which information is perceived as accurate, distorted, changed, etc., as it is transmitted in organizations. Generally, the data here suggest that an appropriate next step in this kind of research is first to identify characteristics associated with individuals who are stable in their role occupancy (because so many are) and then to look at correlates of role change.

Group Properties of Networks

An interesting finding here is that the number of members a group can accomodate appears to stabilize at least as reflected in mean and median group size. This point of stability is generally similar across the three networks. It would be interesting to know, particularly

for expertise networks, whether groups larger than or smaller than the central tendency perform better or worse than those at the mean. In social networks deviation from mean number of members by a group may be related more to perceptions about groups, such as those related to group climate, than to performance.

In authority networks groups are initially small but appear to stabilize at about the same size as they do in other networks, giving further support to the possibility that at some point size equilibrium is reached. Other research (Richards, personal communication) shows that when the point of group size equilibrium is reached groups sub-divide. The point of equilibrium seems to be around ten to twelve group members in a number of different kinds of organizations investi-gated. Larger groups than this are less internally connected giving rise to a possible need for subdivision.

Groups are generally expected to develop (or become more inter-connected) as organizations mature. Note that while empirically this is the case for expertise groups, groups in authority networks never achieve the size or development they do in either social or expertise networks. This suggests at least three possibilities which should be explored empirically. One is the often stated (but unsupported) supposition that organizations develop to do what they have to (accounting for expertise group interconnectedness) and in so doing create informal groups to handle issues not handled in task related interactions. The authority system may get in the way of this process (less integrated authority groups over time). Tangential to this one might hypothesize that expertise groups develop first, forcing

the development of social groups. Allen provides some data suggesting
this happens (personal communication). An investigation of this point
would require numerous observations over short time intervals. A
third possibility is that the pre-determined nature of authority groups
places limits on their development which do not operate for the other
groups.

Another ramification of increased or decreased group connectedness
over time which should be explored is the impact it (as opposed simply
to group size) has on perceptions about work climate. In highly inte-
grated groups do members perceive their groups as more supportive of
their efforts, more able to engage in high quality problem solving, etc.,
than do members of less integrated groups? Is this more true for groups
defined in terms of expertise interactions than in terms of social
interactions? Are their differences in perceptions of organizational
climate by groups defined in terms of communication interaction, by
job function, by department, etc.?

These remarks about groups have focused primarily on possible
outcomes associated with various group communication characteristics.
Equally important are antecedents of such factors as the development
of large and small communication groups and interconnected and non-
interconnected groups. Some of the possible antecedents undoubtedly
reflect setting characteristics (one level removed from group charac-
teristics) such as total organizational size. Some characteristics
of groups themselves may determine their size and integration. For
example, the nature of group interaction may determine size, though
it does not appear to do so in these data. However, one might expect

expertise groups to be characterized by greater homogeneity in job function than social groups. Or job homogeneity may predict group size or integration regardless of group communication content. Size itself probably determines, or at least is negatively correlated with, degree of integration (Davis, 1969).

Network Properties

When we focus on the development of networks we find that time assists their stabilization. The network literature (see Lindzey & Byrne, 1969; or Shaw, 1964) indicates that a learning process occurs in organizations. This kind of process may be reflected in our data suggesting that learning type activities which might occur should be looked at early in an organization's life. While the data here do not indicate when stabilization takes place, the phenomena should be given more attention in conjunction with the possible coexistence of learning type activities.

In a laboratory investigation of embedded networks Cohen, Robinson, and Edwards (1969) indicate that non-group members develop contacts such that they aid in the total "hooking up" process of organizations. Here liaison (non-group members) and bridge (group) contacts grow together, suggesting that groups cannot act without help in integrating themselves into networks. And as organizations grow more linking activities are required. Note the greater effort required to maintain expertise networks than social or authority networks. This higher effort requirement is reasonable if expertise networks really drive organizational systems. Attention should be given to identifying those content based interaction systems which are at the heart of

organizing. These data do suggest the relative unimportance of formal authority systems in comparison with other kinds of systems in operating organizations. They follow Wickesberg's (1968) finding that organizational contacts are larger than the span of control suggests them to be and suggest that defining organizations in terms of their formal authority charts may be a rather poor method of description. As indicated before, the degree to which groups are sharply or narrowly delineated from one another in various communication content derived networks should be examined.

Another way to think about network stabilization over time is to consider why organizations stabilize. Note here expertise networks become the most stable, and if these networks are at the heart of organizational development we can hypothesize the necessity for quick and extensive reduction in information equivocality (Weick, 1969) if the primary tasks of organizations are to be completed. The fact that expertise networks grow largest and become more integrated than social or authority networks supports the contention of their greater importance and perhaps their vulnerability to destruction. Size and integration may be bracing mechanisms: "A brace is strongest where the force tending to destroy the structure is strongest. As organizations grow, the bracing material will grow where the destructive forces are focused, (Haire, 1964, p. 305)." On the other hand, Weick's (in press) contention that there may be conditions under which "loose coupling" contributes to organizational viability should also be examined. The methodology used here allows the investigation of loose and tight coupling and possibly its antecedents and consequences.

CONCLUSION

The investigation reported here is an example of a different way to describe organizations than is usually found in the literature. Organizational descriptions in information structure terms may uncover basic units of organizational functioning which can then be related to some aspects of organizational processes such as behaviors and attitudes.

The framework from which the investigation began suggests the importance of first defining outcroppings of a concept of interest at different analytic levels. Using the outcroppings or organizational regularities observed, hypotheses were developed relating descriptive structural communication variables to organizational processes. The framework suggests that future explorations of relationships among communication and other variables should first be within levels and then between them. These activities should lead to the development of theoretical notions in an area which is to date completely devoid of descriptive or predictive theoretical orientation.

Footnote

References

Barnard, C.
1938    The Functions of the Executive.  Cambridge:  Harvard University
        Press.

Berlo, D.K., Farace, R.V., Monge, P.R., Betty, S.A., and Danowsky, J.A.
1972    An analysis of the communication structure of the office of civil
        defense.  Unpublished paper, Department of Communication, Michigan
        State University.

Bertalanffy, L. von
1962    "General system theory - A critical review."  General Systems:
        Yearbook of the Society for General Systems Research, 7:1-20.

Buckley, W.
1967    Sociology and Modern Systems Theory.  Englewood Cliffs, N.J.:
        Prentice-Hall.

Buckley, W. (ed.)
1968    Modern Systems Research for the Behavioral Scientist.  Chicago:
        Aldine.

Cattell, R.
1966    Handbook of Multivariate Experimental Psychology.  Chicago:
        Rand-McNally.

Churchman, C.W.
1968    The Systems Approach.  New York:  Dell.

Cohen, A., Robinson, E., and Edwards, J.
1969    "Experiments in organizational embeddedness."  Administrative
        Science Quarterly, 14:208-221.

Davis, J.
1969    Group Performance,  Reading, Mass.:  Addison-Wesley.

Davis, K.
1953    "Management communication and the grapevine."  Harvard Business
        Review, 31:43-49.

Dubin, R.
1969    Theory Building.  New York:  Free Press.

Farace, R., Richards, W., Monge, P., and Jacobson, E.
1973    Analysis of human communication networks in large social systems.
        Unpublished manuscript, Michigan State University.

Guetzkow, H.
1965    "Communication in organizations."  In J. March (ed.), Handbook of
        Organizations:  534-573.  Chicago:  Rand-McNally.

Haire, M.
1959    "Biological models and empirical histories of the growth of
        organizations." In M. Haire (ed.), Modern Organization
        Theory:  272-306.  New York:  Wiley.

Herman, J.B., Dunham, R.B., and Hulin, C.L.
1975    "Organizational structure, demographic characteristics, and
        employee responses." Organizational Behavior and Human
        Performance:  13:206-233.

Katz, D. and Kahn, R.
1966    The Social Psychology of Organizations.  New York:  Wiley.

Kerlinger, F.N.
1972    Foundations of Behavioral Research.  New York:  Holt.

Lazarsfeld, P. and Menzel, H.
1969    "On the relation between individual and collective properties."
        In A. Etzioni (ed.), A Sociological Reader on Complex Organizations:
        499-516.  New York:  Holt.

Lindzey, G. and Byrne, D.
1968    "Measurement of social choice and interpersonal attractiveness."
        In G. Lindzey and E. Aronson (eds.), The Handbook of Social
        Psychology:  Vol. 2:452-525.  Reading, Mass.:  Addison-Wesley.

MacDonald, D. and Farace, R.V.
1972    Approaches to the study of communication in organizations:  An
        example of applied theory in a large financial institution.
        Unpublished paper, Department of Communication, Michigan State
        University.

Monge, P. and Lindsey, G.
1974    The study of communication networks and communication structure
        in large organizations.  ONR Technical Report #1, Contract
        N0014-73-A-0476:  April 1974.

O'Reilly, C.
1975    The intentional distortion of information in organizational
        communication:  A laboratory and field approach.  Unpublished
        dissertation, University of California, Berkeley.

O'Reilly, C.A. and Roberts, K.H.
1975    Communication groups in organizations:  Some antecedents and
        consequences.  Unpublished paper, University of California,
        Berkeley.

O'Reilly, C.A. and Roberts, K.H.
1975    "Credibility and communication in work units." Journal of Applied
        Psychology, in press (A)

O'Reilly, C. and Roberts, K.H.
1975    "Individual differences in personality, position in the
        organization, and job satisfaction." Organizational
        Behavior and Human Performance, in press (B)

O'Reilly, C. and Roberts, K.H.
1974    "Information filtration in organizations:  Three
        Experiments." Organization Behavior and Human Performance,
        11:253-365.

O'Reilly, C. and Roberts, K.H.
1975    Personnel Ratings and Systemic Performance Characteristics
        Related to Interpersonal Communication in Organizations.

Porter, L. and Roberts, K.H.
1975    "Organizational communication." In M. Dunnette (ed.)
        Handbook of Industrial and Organizational Psychology.
        Chicago:  Rand-McNally, pp. 1553-1589.

Richards, W.D.
1974    "Network analysis in large complex systems-metrics."
        Paper presented at the meetings of the International
        Communication Association, (A).

Richards, W.D.
1974    "Network analysis in large complex systems - Techniques
        and methods - tools." Paper presented at the meetings of
        the International Communication Association, (B).

Richards, W.D.
1974    "Network analysis in large complex systems - Theoretical
        basis." Paper presented at the meetings of the Inter-
        national Communication Association, (C).

Richards, W. and Lindsey, G.
1974    "Social analysis:  An overview of recent developments."
        Paper presented at the American Cybernetics Society
        Conference, Philadelphia, Penn.

Roberts, K.H. and Hulin, C.L.
1974    "An approach to behavioral science research in organizations."
        Technical Report #6, University of California, Berkeley.
        Contract N000314-69-A-0200-1054, Office of Naval Research.

Roberts, K.H. and O'Reilly, C.A.
1975    Communication roles in organizations:  Some antecedents and
        consequences.  Manuscript submitted for publication.

Roberts, K.H. and O'Reilly, C.A.
1974   "Failures in upward communication in organizations:
       Three possible culprits."  Academy of Management Journal,
       17:205-215, (A).

Roberts, K.H. and O'Reilly, C.A.
1974   "Measuring organizational communication."  Journal of Applied
       Psychology, 59:321-326, (B).

Roberts, K.H., O'Reilly, C.A., Bretton, G.E., and Porter, L.W.
1974   "Organization theory and organization communication:  A
       failure to communicate?"  Human Relations, 27:501-524.

Rogers, E. and Shoemaker, F.
1971   Communication of Innovations.  New York:  Free Press.

Shannon, C. and Weaver, W.
1949   The Mathematical Theory of Communication.  Urbana, Illinois:
       University of Illinois Press.

Shaw, M.
1964   "Communication networks."  In L. Berkowitz (ed.) Advances in
       Experimental Social Psychology.  New York:  Academic Press,
       1:111-149.

Simon, H.
1957   Administrative Behavior.  New York:  MacMillan.

Simon, H.A.
1962   "The architecture of complexity."  Proceedings of the American
       Philosophical Society, 106:458-482.

Sutton, H. and Porter, L.W.
1968   "A study of the grapevine in a governmental organization."
       Personnel Psychology, 21:223-230.

Thayer, L.
1967   "Communication and organization theory."  In F.E.X. Dance (ed.)
       Human Communication Theory:  Original Essays.  New York:  Holt.

Weick, K.E.
1975   "Research agenda for educational organizations as loosely
       coupled systems."  Administrative Science Quarterly, in press.

Weick, K.E.
1969   The Social Psychology of Organizing.  Reading, Mass.:  Addison-
       Wesley.

Wickesberg, A.
1968   "Communications networks in the business organization structure."
       Academy of Management Journal, 11:253-262.

Table 1

Individual Participation and Isolation in Three

Communication Content Derived Networks

| Networks | Role | Time 1 | Time 2 | Stability of role occupancy over time within each network |
|----------|------|--------|--------|-----------------------------------------------------------|
| Expertise | Participant | 80.3% | 73.4% | 76.0% |
| | Isolate | 19.7% | 26.6% | |
| Social | Participant | 80.4% | 72.2% | 71.0% |
| | Isolate | 19.6% | 27.8% | |
| Authority | Participant | 42.1% | 38.0% | 59.0% |
| | Isolate | 57.9% | 62.0% | |

Table 2

Cross Network Role Similarity and Stability Over Time

| Networks | Time 1 | Time 2 |
|---|---|---|
| Expertise & Social | 80.4% | 81.9% |
| Expertise & Authority | 59.6% | 61.5% |
| Authority & Social | 58.7% | 60.0% |

Table 3

Group Properties of Three Communication

Content Derived Networks

| Parameter | Network | | | | | |
|---|---|---|---|---|---|---|
| | Expertise | | Social | | Authority | |
| | Time 1 | Time 2 | Time 1 | Time 2 | Time 1 | Time 2 |
| Number of Group Members | 272 | 407 | 162 | 415 | 85 | 275 |
| Number of Groups | 27 | 44 | 16 | 38 | 12 | 30 |
| Mean Group Size | 10.1 | 9.3 | 10.1 | 10.9 | 7.1 | 9.2 |
| Approximate Mdn. Size | 9 | 6 | 7 | 7 | 6 | 6 |
| Mean Connectedness | .50 | .57 | .60 | .53 | .51 | .44 |

Table 4

Network Properties of Three Communication

Content Derived Networks

| | Network | | | | | |
|---|---|---|---|---|---|---|
| | Expertise | | Social | | Authority | |
| Parameter | Time 1 | Time 2 | Time 1 | Time 2 | Time 1 | Time 2 |
| Number of Liaison Contacts | 62 | 164 | 36 | 105 | 3 | 87 |
| Number of Bridge Contacts | 84 | 198 | 38 | 174 | 3 | 97 |
| Total Linking Activities | 146 | 362 | 74 | 279 | 6 | 184 |
| Links/ Groups | 5.41 | 8.22 | 4.63 | 7.34 | .5 | 6.13 |
| Links/ Members | .54 | .88 | .46 | .67 | .07 | .67 |