The Role of "Help Networks" in Facilitating Use of CSCW Tools

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ABSTRACT

The pattern of CSCW system users helping other users to resolve problems and make more effective use of such tools has been observed in a variety of settings, but little is known about how help patterns develop or their effects. Results from a pre-post study of the implementation of CSCW tools among university faculty, staff and administration indicate that the network of helping relationships is largely disaggregated and generally follows work group alignments rather than technical specialization. A relatively small group of "high providers" is responsible for most help to users, and tends to act as a liaison between central support staff and work group members. These providers are not systematically different from other personnel except in terms of their expertise. Implications of these findings for the development and cultivation of help relationships in support of CSCW are developed.

INTRODUCTION

For a considerable time, it has been a commonplace in the analysis of computer-supported cooperative work (CSCW) to note that the best design in the world can never produce a system that users will use without a significant amount of help on an ongoing basis. As CSCW tools become more complex, add new and improved features, and integrate more aspects of work, the ability of organizational help systems to provide ongoing support is under increasing pressure. Documentation is generally inadequate, training is scarce and expensive, and the tools themselves are more complex and multifunctional. While interface design has made substantial progress in improving the accessibility of tools to new users, it is generally conceded that effective implementation of CSCW technology requires a continuing investment in user support [16,33].

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From the days when Douglas Englebart began to define the core concepts of CSCW [9], analysts have observed the phenomenon of system users helping other users learn to use the tools, adapt work processes to take advantage of new capabilities, and generally incorporate the system into daily work life. That is, after all, what the "cooperative" element in CSCW is all about [17]. Without question, the information-handling work that is the usual focus of CSCW attention is increasingly performed in highly integrated teams [15,19,36]. Under such conditions, it is logical and necessary to focus on how such teams develop their own internal capacity to provide the help that neither the technology itself nor external support sources can provide fast enough or thoroughly enough.

There has been in recent years increasing attention to the role of "local experts" or "gurus" -- those individuals within work groups who, for whatever reasons, become more competent at manipulating computer-based tools than most of their fellow workers [1]. These individuals usually, although not necessarily, tend to become providers of help and assistance to others within their setting [29]. Their contributions help others to become more proficient with their tools, and hence more productive. They stretch the resources available to organizations for systems management and operation. They frequently serve as work group-level "product champions" [6] for the new tools. Lee [20] calls such individuals "lead users" and notes that they tend to spend more time with their machines and use a wider set of the machine's capabilities than do general users. They also frequently serve as the source of creative tool adaptations that pass from them into the wider population of users.

In the wider organizational literature, this kind of activity has been described as "prosocial organizational behavior" [24], "organizational citizenship" [25], and other terms. In essence, the question is what drives people in organizations to go out of their way to help others -- that is, to perform acts not specified in their official role on behalf of either the organization in general or the people within it. Brief and Motowidlo [5] characterize such behavior along three dimensions: (a) the degree of role prescription of the behavior, (b) the target of the behavior (the individual or the organization), and (c) the functionality of the behavior for the organization generally. Despite the attention to the issue, there is no clear consensus on what leads people to undertake such helping behavior. Suggestions include empathy [8] and organizational commitment [23], among others. The concept remains intriguing but elusive.

Assuming the informal "guru" role is certainly a case of prosocial organizational behavior -- but an interestingly different case, in which it is likely that technical interest and concern play as important a role as the more organizationally focused incentives. For example, Mackay [21] distinguishes between the true "technical experts" and "translators" -- those who understand enough about both the technology and the work setting to mediate between those who know one or the other well but not both. She notes that these individuals play a role in legitimating for less technical users some of the technical innovations created by the more system-centered personnel. Clement [7] describes a pattern of mutual collaboration that emerges as a work group strives to make sense of a challenging new set of tools, and the kinds of adaptations that the organizational system must be prepared to make to use such tools creatively. Clearly, the social dynamics of the workplace critically influence the deployment of CSCW tools either for good or ill.

Unfortunately, as Stasz, Bikson, Eveland, and Mittman [31] note, organizations are not always very good at understanding the function played by such local help-providers, or at making a suitable place for them in the system. In fact, those who become proficient at helping others may find themselves censured by the organization generally, particularly if such help-providing comes at a cost to the provider's own direct productivity. It is often difficult to put help-provision in a larger context than that represented by individual relationships. The system-level payoffs of a user-centered help network in terms of relieving pressures on technical personnel are easy to overlook.

It is in search of this broader perspective that we have chosen to focus on some aspects of the network properties of a CSCW implementation process. The use of network analysis techniques has provided a number of interesting insights into the dynamics of CSCW implementation generally and in particular the role of interpersonal communication arrangements in affecting system learning and usage. Papa [26], for example, reports that individuals with more integrated and diverse interpersonal networks tended to use computer tools more productively. Eveland and Bikson [11] note that centrality in a computer-based work group tends to be associated with higher levels of tool use and greater control over work group direction. Rice and colleagues [27,28] have applied network techniques extensively to the question of understanding how electronic communication media come to be deployed. But in general, network analysis has not been employed extensively, despite its general utility in making visible the larger issues of system utilization [10].

The present study focuses on the specific issue of how "help networks" form and operate in an organization undergoing a significant shift toward computer support for cooperative work. In particular, we set out to determine (a) is there a definable help network or networks and (b) if so, what might characterize the relationships within it. If organizations are to be able to facilitate the development of effective help networks as they move into the CSCW environment, they must know something about how to identify them and how they seem to emerge.

THE CURRENT RESEARCH PROJECT

The Setting

The research described here is part of a longer-term program of assessment of the effects of changes in the computing environment at the Claremont Graduate School. CGS is a private, free-standing U.S. graduate school, enrolling about 2,000 students with a combined faculty, staff, and administration of approximately 200. In a sense, this is an opportunistic research effort. About two years ago, CGS received two significant foundation grants to upgrade computing hardware for faculty and students. From a state as late as 1992 in which there was virtually no support for non-mainframe computing, CGS has been moving into a PC-based networked environment with up-to-date machines provided to all faculty and widely available to students. In parallel, the school has undertaken a major upgrade in the computing support for the administration. Thus, we have been able to observe a natural experiment in a setting with which we have, obviously, great familiarity.

As an institution, CGS offers some interesting features. Like most universities, it is made up of semi-autonomous work groups physically spread out across the relatively compact campus, dispersed over about 12 locations in a five square block area. A centralized Academic Computing Center (ACC) with six staff is responsible for coordinating implementation and providing support to all users; two separate staff people in administrative computing are mainly responsible for that side of operations. Apart from the Information Sciences Department, CGS has no technically oriented programs; its largest departments are Management, Education, and Psychology. Thus, there is no significant group of computer-oriented technical specialists to skew the findings. Overall, CGS offers an excellent opportunity to watch how the implementation of new computers has affected users, as well as to examine the information sharing processes involved in adapting to the system and the system to the setting.

Structure of the Study

Our study was designed to consist of two rounds of survey data. The first round of surveys was completed over a four-month period (December 1992-April 1993), as new equipment was installed in departments and offices (the aim was to have pre-data collected as close to installation as possible; an aim largely achieved.) The second round was completed in January 1994, a point at which most respondents had at least nine months experience with the new systems.

Between faculty, departmental staff, and administrative personnel, over 150 employees received new computing equipment. In Round 1, 119 surveys were distributed, with 101 responses. This high response rate was at least partially due to an energetic follow-up campaign. Round 2 surveys went to 153 people with 110 participants returning completed surveys. The increase in distributed surveys in Round 2 was due to the addition of new staff and the inclusion of some units that had not participated in Round 1. Seventy-three participants completed both rounds of the survey. Table 1 describes the basic demographics of this sample.

	Round 1	Round 2
Faculty	36%	39%
Dept. Staff	14%	20%
Admin. Staff	35%	31%
Supervisors	15%	10%
Male	32%	33%
Female	68%	67%
Median Age	46	45
Median Job Tenure at CGS	7 Years	7 Years
Mean Education Level (1-4 Scale)	2.8	2.8
Percent Full Time	90%	90%
Total N	101	110

Table 1: Demographics of the Sample

The Survey Instrument and Measures

The five-page survey covered six general topics:

demographics, including computer use in formal education and self-rank as a computer user

the extent to which respondents use their computer's capabilities

the types of information work they do at their job, and if they use a computer to do this work

satisfaction with the computing environment

expectations about the future of their computer use (at Round 2, the degree to which their expectations have been fulfilled)

interactions with others regarding the computer.

To measure self-rank as a computer user, respondents were asked to categorize themselves as novice, beginner, intermediate, advanced, or expert. Use of computer capabilities was measured by asking respondents to estimate to what extent they use the full capacity of computer programs available to them, on a five-point scale from "almost completely" to "hardly at all." The "information work" items listed 13 commonly performed tasks such as "writing text," "producing reports," "managing databases," and "use of the library," and asked respondents to indicate how often they carried out such tasks (frequently, sometimes, or never), and if so, how often they used a computer to do them. The items themselves have been used earlier in a variety of information work contexts, and have proved to be reasonably comprehensive [2]. Satisfaction was measured with 20 items asking about different aspects of the computing and file management environment; again, these items have been tested in earlier studies. Expectations were measured with 10 items, some reflecting positive possibilities and some negative.

Interaction data were gathered with standard sociometric methods [18,22,30]. Given the size of the sample and the potential open-endedness of the network, a roster technique was judged impractical. Rather, respondents were asked to nominate up to six individuals in each of three categories:

people with whom they work regularly

people to whom they go for help when they have problems with the computer

people to whom they provide such help

Such a nomination technique produces more constrained data than a full roster, but is acceptable in cases where either the network is too large or the subgroups detected within it are expected to be small -- both conditions that apply here [12]. Responses to these questions were used to construct "who-to-whom" contact matrices for each set of relations.

By combining the data from the two questions regarding help provision (inverting the nominations obtained in answer to the second question), we constructed a full set of helper/helpee connections. In constructing this list, we did not insist on reciprocal acknowledgment of help ties, allowing instead a tie to exist if either party said that it existed. This use of unreciprocated ties is acceptable in many cases, particularly those where the tie may be relatively weak and where data are not obtainable from all participants in the system [14,18,32]. Help may be one of those phenomena which is not always perceived in the same way by both parties to the relationship. In fact, the amount of reciprocally acknowledged help ties was less than 10% of the total ties. In any event, the use of unreciprocated ties does not seem to weaken the analysis significantly.

Analysis Techniques

In the sections that follow, we present data relating to the shape and functioning of the "help network" that has emerged in CGS since implementation of the new computers. Most of our findings are based on the Round 2 data, since it is at Round 2 that the system is fully functioning. In certain cases, we present Round 1 data as well to develop contrasts over time.

Certain relationships are described as "significant." In most cases, this means that a t-test between two groups (such as "high providers" and "non-providers") identifies a significant difference between the groups at $p<.01$. Where multiple tests are used simultaneously, a significance level of $p<.001$ is used. Where more than two groups are identified, ANOVAs with the same significance levels are employed.

OVERALL FINDINGS

The Pattern of Help Relationships

A number of interesting properties of the who-to-whom help network can be charted using the analysis program UCINET IV [4]. This program is a set of integrated routines for identifying and analyzing different aspects of networks. We have also used NEGOPY, a clique-detection and assessment package [32]. From these analyses, some intriguing features of CGS's help network stand out.

First, the network is extremely disaggregated. Its overall density (the proportion of actual ties in the network to potential ties) is less than .10. Relatively few cliques can be identified, and those that exist almost entirely parallel existing work groups (see below for more development of this issue). Under these conditions, it is not particularly meaningful to try to assess integrativeness (the degree to which the networks of particular individuals overlap), as Papa [26] was able to do; integrativeness in the CGS help network seems to be entirely a local rather than a global phenomenon.

Second, individual centrality appears to be rather randomly distributed across the network. Apart from the expected high centrality of the ACC staff, whose explicit job is to provide help to users, the individuals most central in the network are scattered across departments and staff offices in no particular order. This suggests that it might be useful to investigate the characteristics of such individuals who appear to have assumed the "local expert" function -- or at least who have been identified by their fellows as such.

What do these "Help Providers" look like?

The way to identify the provider group is to look at the pattern of participation in help relationships. Analysis of the who-to-whom help matrix using UCINET IV generates a variety of centrality statistics [13]. The simplest and most direct measure of such help is *out-degree centrality* -- that is, the number of relationships in which one participates as a helper. This measure is highly skewed in its distribution (Figure 1), with the mean number of help relationships being 1.15 .

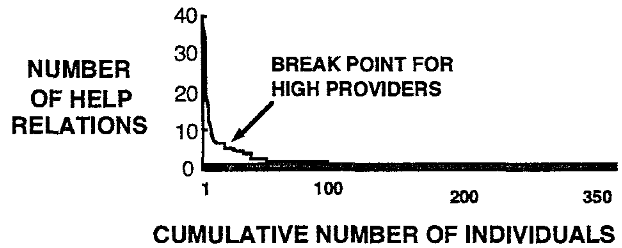

Figure 1: Cumulative Distribution of Help Relationships

As Table 2 indicates, with the exception of the Academic Computing Center staff, no group is notably more involved than any other, although faculty are somewhat less likely to participate in help, possibly because of their rather less predictable availability to others.

	Relations	N
Faculty	1.68	40
Dept. Staff	2.10	20
Admin Staff	2.31	32
Supervisors	3.73	11
ACC Staff	20.00	9

Table 2: Average Help Relationships by Function

"Help behavior" is certainly a continuously distributed variable. However, assessing what is special about high help providers is probably more appropriately done by distinguishing the group of "high providers" and developing contrasts between them as a class and the rest of the participants. To do this, it is necessary to set a criterion for distinguishing between the groups. We defined as our criterion for characterizing an individual as a high help-provider to be participation in *five or more* help-relationships (the basis for this selection was the break in the cumulative distribution curve at that point). In the second round of data, we identified 29 individuals as such "high-providers," with individual data obtained regarding 21 of them (the others are ACC staff, who were not surveyed). While this distinction is somewhat arbitrary, it does allow us to define a group who (a) clearly participate extensively in providing help to others, and (b) differ from the majority of their colleagues in doing so.

Are High Providers Different?

Once one has determined that there are in fact a relatively small number of definable high help providers, the first logical question to ask is what distinguishes them from their fellow workers. Who are they, and what are their characteristics?

To identify any peculiarities distinguishing these high providers, we contrasted them with the 45 individuals from whom we obtained Round 2 data who provided *no* help to any others. Interestingly, given all we know about the participants in the study, there are only five areas in which high providers are different from these non-providers (as noted earlier, all differences are significant at $p<.001$):

Self-reported expertise: We asked respondents to characterize their own level of computer expertise on a five-point scale from "novice" to "expert." High providers averaged 3.6 (between "intermediate" and "advanced"); non-providers, 2.6 (between "beginner" and "intermediate"). It is important to note, however, that not all advanced users are in fact high help providers; in fact, 56% of the self-identified "advanced" users are *not* high providers, while 36% of the high help providers rank themselves no more than "intermediate." Of the nine non-provider advanced users, two are faculty members, who might be expected to have a lower level of work interaction with others, and the remaining are departmental support personnel.

Types of Information Work: We asked respondents about their use of computers in performing a wide variety of information-processing tasks. This measure refers primarily to the *kind* of work done rather than to specific tools. High providers were more likely to work with databases, spreadsheets, formatting or typing, graphics, and calendars than were non-providers.

Allocation of Computer Time: Although the amount of time high providers and the non-providers spend on the computer is not significantly different (at 4.7 and 3.9 hours per day respectively), the ways they allocated their time differs in many respects. For example, non providers spend 75% of their time working with text while high providers only spend 52% of their time on text. Conversely high providers spend more of their time on graphics and numbers than do the non-providers.

Use of Applications: We asked respondents to tell us how many different generic applications they used (word processing, databases, spreadsheets, etc.), and the degree to which they believed they were using the full capabilities of each. In contrast to the information work items which dealt with how often they perform certain tasks, this measure refers specifically to *tool usage*. That is, it deals with how well they use these applications. High providers averaged 4.1 applications (out of five possible), with average use of each at a 3.6 (out of 5) level; non-providers, 3.0 applications, at an average level of 3.0.

Computer Education: High providers were more likely to have taken at least one computer course over their formal education than were non-providers (55% to 20%). However, no other aspect of educational background distinguishes between the groups.

On balance, what is most interesting is how similar the groups are on many other dimensions that at first glance might seem to be reasonable predictors of helping. As Table 3 indicates, there are no differences between the groups in organizational level, gender, age, or educational level.

	Total Sample	High Provider	Non-Provider
Faculty	39%	33%	43%
Dep't Staff	20%	19%	14%
Admin Staff	31%	33%	36%
Supervisor	10%	14%	7%
Male	33%	33%	33%
Female	67%	67%	67%
Mean Age	45.4	40.7	45.5
Mean Educational Level (1-4 Scale)	2.8	2.5	3.1
Total N	110	21	45

Table 3: Demographics of Help Providers

There are no differences in usage of different kinds of external help sources such as training courses, manuals, or the ACC staff. However, there is a difference in how beneficial providers and non-providers perceive on-line help systems. On a five point scale high providers scored 2.6 while non-providers scored 1.8. The groups do not differ in their use of some of the more advanced features of CGS's CSCW environment, such as use of network features; both groups report relatively low levels of use. This is probably a function of the newness of these features; even the experts have not yet fully achieved its potential.

Overall, high providers appear to be distinguished by the things that they *do* with their computers, rather than by who they *are*, at least in terms of demographics. This is consistent with the majority of studies that have examined the relationship of demographic variables to computer behavior, and found essentially no consistent patterns [3,20]. Obviously, there may well be *personality* characteristics or other individual variables that might differentiate such individuals who are predisposed to participate in help relationships, and this is an area that deserves further attention.

Changes in Provider Patterns over Time

Over the year in which CGS implemented advanced computing for faculty and staff, a number of interesting changes took place in help relationships and the nature of the high-provider group. Our data make it clear that the evolution of help relationships is dynamic, and that help patterns are likely to change in ways that are probably largely unpredictable.

Among the 101 respondents to the Round 1 (pre-implementation) survey, a total of 533 helping relationships were reported. 333 were instances of others providing help to the respondents; 200 were cases in which the respondent provided help to others (a ratio of 1.67:1). At Round 2 (one year later), a total of 506 help relationships were reported, with 320 receiving and 186 giving help. Although there is a slightly higher number of helping relationships in Round 1, the difference is not significant. The ratio of receiving help and giving help relationships does change between the rounds. At Round 2, the ratio of receiving to giving is help is 1.72:1. Thus, there is a very modest increase in the amount of people seeking help relative to the number of people who provide it.

Using the criterion of five or more helping relationships (see above), we identified 27 providers in Round 1 and 29 providers in Round 2. Of these, eight in each round were ACC staff and thus excluded from the staff help network as we have defined it.

Across the two rounds, 17 participants (including the eight ACC staff) were identified as providers both times. Thus, 10 providers left the provider group in Round 1 and 12 new providers emerged at Round 2 (two of the Round 1 providers left CGS, and two of the new Round 2 providers were hired after Round 1). Most of the dropouts from the Round 1 provider group continued to provide help, although at lower levels than earlier. Of the dropouts, four were faculty, six administrative personnel; of the Round 2 additions, five are faculty, seven administrative. There appears to be nothing systematically distinguishable about either dropouts or additions. Rather, it is probably the case that there is a relatively high degree of fluctuation in who is central in the staff help network at any given time. The instability of the network may be complicated by the dynamics of a first year of implementation, when relationships are likely to shift more as experience is gained with the tools.

While both high providers and those who were not so identified increased their overall level of involvement in help relationships over the year, it is clear that providers increased their involvement to a larger extent. Figure 2 shows the per capita change in number of help relationships by provider group (note that the contrasts that follow are based on all non-high provider respondents in the data set, not only the 45 individuals described above as having no help relationships at all). On average, those not identified as providers decreased their participation in help relationships by about -.33; whereas high providers increased their participation by over 1.2.

Of the total of 506 help relationships at Round 2, 164 (32%) were cases where ACC staff helped other CGS personnel. There are also instances of individuals receiving help from a provider outside of CGS, such as a friend or family member, or colleague at another institution. Table 4 shows the overall pattern of sources to which the different groups go for help.

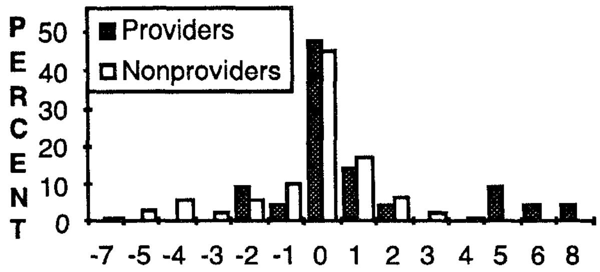

Figure 2: Per Capita Change in Numbers of Help Relationships

	Receivers of Help	
Help Sources	High Providers	Non-Providers
High Providers	16%	15%
Non-Providers	14%	24%
ACC	51%	51%
Outside CGS	19%	10%

Table 4: Sources of Help

One question of interest is the relationship between help provided by ACC staff and help provided by CGS staff to each other. Is there a variety of "two-step flow" similar to that described by Mackay [21], in which ACC helps some people, who in turn help others? Although this hypothesis is largely discredited in its original context of mass communications, it may still be valid in a context of limited and specialized information like that of computer support. There is some suggestion that this may be true, but the evidence is not clearly defined. Help providers do report a notably greater number of contacts with ACC staff than do non-providers, particularly at Round 2 (an average of 3 ACC contacts per provider, vs. 1.3 for non-providers, up from 2 and 1.2 respectively at Round 1). Table 5 shows the average changes in both local and ACC contacts for both groups between Round 1 and Round 2 (the sample here includes only those cases for which we have valid data from both rounds).

	"Local" Contacts	Contacts with ACC
High Providers N=17	Down 1.2	Up 1.0
Non-Providers N=56	Up .09	Down .14

Table 5: Increases in Help Relationships from Round 1 to Round 2

Thus, providers tended to have the largest changes in their help relationships from Round 1 to Round 2. They increased their contacts with ACC and decreased contacts with other staff. Non-providers tended to decrease contact with the ACC and slightly increase their help relationships with other local users. Perhaps those users identified as high providers in Round 2 initially had more contact with other local users, but by Round 2 had gravitated towards more help relationships with the ACC. The lower level users only slightly change the number of help relationships in which they are involved; perhaps selecting the local high providers more often. This supports Mackay's model, and suggests that CGS has been able to transfer at least some of the help burden from direct staff resources at the ACC to the work group-based help networks.

Over the implementation year, both high provider and non-provider groups recorded increases in certain information work tasks, particularly report generation, desktop publishing, library access, and calendaring. Small decreases were actually reported in use of databases and statistics. The only significant differences between the information work changes reported by providers and those of non-providers were in desktop publishing and calendaring. High providers reported greater use of these relatively more advanced applications.

Characteristics of Helper/Helpee Relationships

One advantage of network data that it allows identification of specific *pairs* of individuals involved in helping relationships. In this section, we report on some interesting features of these helper/helpee dyads. At Round 2, the 21 non-ACC high providers were involved in a total of 164 help relationships. We have complete data for both parties on 72 of these dyadic connections. The vast majority of these involved high providers with non-high providers; only six of the relationships were reciprocal connections between high providers.

The observation earlier that high providers tend to have greater computer skills and involvement than do non-providers is borne out in these relationships. For example, high providers use a larger portion of the computer's capabilities on each of its tools than the people they are helping. Across all tools used, over 70% of the high providers use at least as much of the capabilities as the people they are helping, and 25% of the high providers consistently use tools at least one full level higher on the five-point scale described earlier. This means that for every tool the provider and the person she or he is helping use in common, the provider is consistently using more of its capabilities, and is more of an expert in that particular tool. The biggest difference in exercise of capabilities appears to be with spreadsheets and graphics; over half of the high providers use at least one more level (again, on the five-point scale) of the capabilities of these tools than the people they are helping.

Not surprisingly, physical and organizational location matters. The vast majority of the dyads (74%) involve pairs of people who work in the same department or immediate work group, usually no more than a few doors separated. Of the remainder, 17% involve pairs who are in different work groups but the same general physical location. This makes sense as well, and is consistent with past findings on the relationship of physical proximity to collaboration [2,19]. Particularly on the administrative side, CGS units tend to be rather small, and several units often share close quarters and even a common work group atmosphere; the lines are not closely drawn. Only 9% involve individuals separated both physically and administratively. Clearly, the vast bulk of help relationships involve people who are in close proximity. People for the most part simply do not go for help to people out of immediate reach, even though those people might have the computer knowledge, maybe even better knowledge, to resolve the issue. This probably reflects as well the major importance of context knowledge to the resolution of computer problems; people go to people who know their work problems as well as the technology [2].

This point is reinforced by looking at the nature of the work being performed. Similarity of work tasks appears to be a major factor in maintaining help relationships. As noted earlier, we asked our respondents about a variety of information work that they performed, with or without a computer. The majority of dyads have at least five work tasks in common, probably not unusual within work groups but not necessarily so across the whole school. Across all dyads, common tasks account for a bit more than 50% of the total common work that the dyad partners perform. Thus, most of the dyads are made up of people performing largely the same sort of information work -- although perhaps in different degrees or at different levels. The similarity is perhaps stronger than might be thought. About 15% of the providers and 21% of the help recipients have *no* unique tasks. That is, they both do exactly the same sort of work. This probably indicates that help recipients tend to go to people who can help them across all aspects of their information work. On the other hand, high help providers tend to perform a wider range of information tasks than the people they help, which might help account for their greater degree of expertise.

Interestingly, status appears to be something less than a major determinant of the directionality of help relationships. In this group, 32% of the dyads were pairs in which the superior-status person (defined as faculty or administrative supervisor) provided help to a subordinate (support staff). 46% were peer-to-peer dyads, while 22% were subordinate-to-superior help relationships. The latter group are particularly interesting in that superiors are generally reluctant to admit lack of knowledge to subordinates; the circumstances of these subordinate-to-superior connections deserve further exploration.

On balance, location and task similarity seem to be the primary determinants of help relationships. Demographic characteristics, by contrast, seem of little help in defining who is or is not likely to become a high help provider.

The Shape of the Networks

One of the interesting features of network data is its utility in producing "maps" of communication relationships. Such maps, often called "sociograms," are graphical representations of connections between individuals or groups [30]. Units that are connected more closely are represented on the map as closer together, and units that are more central in the overall network of connections are closer to the center of the map. Such maps provide a quick overview of an entire set of relationships that is difficult to gain from network descriptors alone, however detailed.

Figures 3 and 4 are sociograms of, respectively, the network of "work" relationships and the network of "help" relationships. Individual responses were aggregated to the level of departments and staff offices and the sociograms generated through multidimensional scaling of the resulting 27x27 contact matrix [12,18]. Overall positions in the sociogram are a function of all the relationships taken collectively; lines represent instances of direct interdepartmental contact.

Figure 3, the "work network," shows a relatively decentralized pattern of offices, centered around the office of the President. The more central programs are the larger and more critical ones -- Management, Education, and the Center for Politics and Economics.

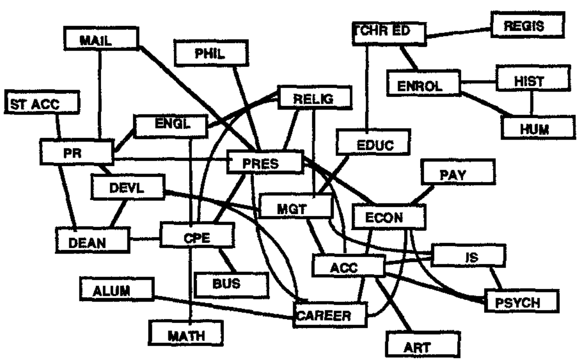

Figure 3: CGS "Work" Network

Except for the President's office, the administrative offices are generally more peripheral, sharing less direct contacts and less overall contacts with the more central programs. Contact lines run more or less at random through the network.

Figure 4, by contrast, shows that the "help network" is notably more centralized, with the ACC not unexpectedly at the center of the "spider web" of help relations. All roads seem to lead to the ACC. The elative paucity of non-ACC paths reflects the tendency, already noted, for help relationships to be centered within departments and programs rather than to cross departmental lines. Exceptions are typically located in similar geographical space.

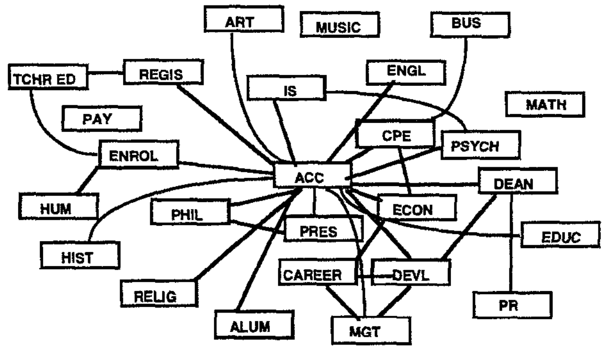

Figure 4: CGS "Help" Network

The main value of the network diagrams is to reinforce the notable differences that exist between help provision and the normal run of cross-group interactions.

DISCUSSION

In our introduction, we posed two general questions guiding our inquiry, We are now in a position to answer them:

> *Is there a "help network"?* Yes, clearly there is. However, it is not one large network, but rather a series of small work group-based networks, linked together by a few "liaisons" who serve as primary help providers and who in turn link users to the central help resources of the organization (the ACC).
>
> *What characterizes the relationships within the help network?* A relatively small number of heavy help providers carry a large part of the total help provision load. These providers tend to be more technically sophisticated and to use more tool capabilities than do users generally. However, they appear to be sought out as much for their similarities to the help recipients in terms of work and position as for their technical qualifications. There appears to be relatively little effect of status or organizational level on the directionality of these helping relationships.

These findings suggest a variety of areas of potential concern and application:

How can we best develop organizational support for the "help providers"? This is a question that all organizations moving in the direction of CSCW, not just CGS, must be prepared to face. Few if any organizations have enough central support resources to answer all the questions that users are capable of posing -- and even if they did, central support personnel are always going to lack the work group context that is needed for help on even moderately complicated issues to be truly effective. CGS appears to be managing the problem at the moment primarily by ignoring it. Initial indications are that there are few active *dis*incentives to provide help (except perhaps in the case of faculty, where time constraints can be complicated). On the other hand, there is certainly little encouragement and incentive to pursue the role beyond the desire to be supportive of others in one's immediate work group. This is perhaps a factor in why most of the help relationships are also work relationships.

CGS is currently contemplating some form of official reinforcement of the help role, although just what shape that would take is unclear. Possibilities include formally identifying individuals in departments and offices as "computer consultants," part of whose job is to liaison between the work group and the ACC, or at least recognizing the services of those individuals who seem to be carrying out the local support role well. Other possibilities include the improvement of work group-based training as new applications become available, designation of "lead users" in particular areas, and other methods to decrease the within-work group variance in capabilities. A key problem is how to provide effective ACC support particularly to high providers, taking maximum advantage of the "two-step flow" .

As CSCW applications become more generally available, MIS support personnel in all kinds of organizations are going to face these same issues, and probably in a more complicated and intractable environment. CGS is, after all, a relatively small and supportive kind of place. In larger and more intimidating settings, the relatively informal arrangements that CGS is managing to muddle through with may simply not work. It is not too early to begin consideration of how to encourage and manage user help before the first specific CSCW tool is brought in.

Should we worry about cultivating breadth and depth of help simultaneously? As we have noted, people tend to go for help to people who do much their own kinds of work, rather than seek out the person most expert in a particular tool. Our observations are that help people (other than ACC staff) tend to be either *breadth* users, who manage reasonable competence across several tools, or *depth* users, who know one or a few tools extremely well. At this point, we do not know which pattern is more effective. It may well depend on the specific tool or on the kind of work -- or it may be that interpersonal dynamics are so important that this distinction is irrelevant. At any rate, some investigation of the interaction of depth knowledge and breadth knowledge is indicated.

How can we encourage simultaneous development of the technical and social infrastructure? CSCW tools, like all technical systems, represent only part of the overall socio-technical pattern of any organization [34,35]. Equally important are the social arrangements that make it possible for the tools to be used effectively by cooperating individuals. The pattern of local support is one key feature of the social system, but it is not the only one. As CSCW designers create new and entertaining tools, they need to apply at least as much thought to evolving effective social relationships as they do to technical excellence.

It is worth noting that the CSCW technology being introduced at CGS is really fairly unsophisticated, at least by the standards of what CSCW professionals are accustomed to regarding as state-of-the-art. However new and advantageous CGS's tools may be to its members, it is clear that there will be new and better tools just over the horizon. Indeed, the current implementation of the campus-wide computer network is providing an indication to CGS that the days of work system stability are probably over, and that living with continuous change in work tools and procedures will become a way of life. The point is that as the cultivation of a systematic help network among CGS personnel proceeds, technical change will become progressively easier to digest. It is also probable that as easy access to our local version of the "Infobahn" becomes more available, the physical distance emphasis found in current help relationships will become less salient. However, the emphasis on similarity of work is likely to continue. In any event, proactive development of social arrangements facilitating new technology is a strategy notably superior to the more common device of air-dropping tools into work groups and then letting them play "catch-up" until the time arrives for the next air-drop.

In sum, the issue of support for and cultivation of helping relationships regarding CSCW tools is alive and well in Claremont -- and everywhere else as well. The more we can find out about what makes people help each other in this context, and how we can reach out to develop help patterns more effectively, the better we will be able to translate the very real advantage of the CSCW tools now coming on line and in the wings into the productivity and work satisfaction we all dearly long for.

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