

## Tie Strength and the Impact of New Media

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### Abstract

*This paper presents a perspective on the impact and use of new media that focuses on the strength of the interpersonal tie connecting communicators. Research shows that more strongly tied pairs communicate more frequently, maintain more and different kinds of relations, and use more media to communicate. It is argued that where ties are strong, communicators adapt their use of media and expand to other media to support the exchanges important to their tie; where ties are weak, communicators rely on few means of contact (often only one), and depend on media and protocols established by others. It is theorized that dependence on a common, widely used medium makes a weak tie network vulnerable to dissolution and reformulation following changes to that medium; by contrast strong ties are more robust under conditions of change since their connection rests on multiple relations and media.*

### Introduction

As the use of computer media becomes widespread and the range of forms and applications increases, researchers and practitioners continue their efforts to understand and plan for the impact of these “new media” in organizations and society. Although theories of media use have been put forward, there is still a need for theories that provide a “framework for synthesis and integration of empirical findings” ([55], p. 13). New media have been portrayed in contradictory ways [48, 64]. On the one hand, they are seen as providing a reduced cues environment ill-suited to emotional, expressive or complex communications, responsible for longer decision times, anti-social flaming behaviors, and decreased social involvement [9, 14, 15, 30, 34, 35]. On the other hand, new media are seen as integrative, connecting disparate others [7, 13], increasing the involvement of peripheral players [12, 53, 54], consolidating existing connections [37], and supporting rich online communities [29, 31, 52, 56, 64]. These contradictions make it difficult to assess the impact of new media, and therefore to plan for its implementation and

use.

This paper argues that a new view can be gained on these disparate results by considering the strength and nature of the social network tie between communicators. In brief, it is argued that where ties are strong, communicating pairs or group members will adapt their use of media to support the exchanges important to their tie, and will use multiple means of communication in an effort to make the kinds of exchanges that support the tie. Such communicators will come to a local understanding of their media use and work together to a joint communication solution [10]. Where ties are weak, individuals have little motivation to communicate and will rely on organizationally (or socially) sanctioned means of communication that provide an impersonal, instrumental contact. It is argued that the impact of tie strength on media use will be most evident with the introduction of a new medium, particularly when that new medium replaces an existing, widely-established means of communication. Positive effects may be seen for strong ties when the new medium provides further means and opportunities for contact, complementing existing communications methods [37, 41, 46, 53, 64], and for weak ties when the medium increases connectivity among otherwise unconnected individuals [7, 64]. However, where the new medium removes or overrides the way in which ties have been maintained in the past, the impact may be disintegrative, removing existing connections and recasting the social networks. Where ties are strong, maintained via multiple media, the impact is likely to be minimal or short lived; but, where ties are weak, maintained via one medium, the impact may be permanent.

### Social network ties

The concept of strong and weak ties derives from the social network literature. Social network analysis takes as its unit of analysis the exchange of resources between actors. Each kind of exchange is considered a social network *relation*, and individuals who maintain relations are said to maintain a *tie*. Patterns of relations and ties form the social networks of resource exchange that

support an environment [44, 60, 61]. Media, whether computer media or more traditional forms, provide a means through which social network ties can be maintained [19, 47, 64].

Social network studies of offline relationships have identified a number of features of ties that distinguish a weaker tie from a stronger one, and these features are important for understanding the interaction between tie strength and media use. Tie strength between pairs of actors can vary from weak to strong, e.g., from acquaintance to friend to close friend, or from co-worker to team mate. Weakly tied pairs engage in fewer, less intimate exchanges, and share fewer types of information and support than those who report stronger relationships. Strong ties involve a higher level of intimacy, more self-disclosure, emotional as well as instrumental exchanges, reciprocity in exchanges, and more frequent interaction [21, 39, 62, 63]. Although some pairs maintain intimacy without frequent contact, these are primarily kinship relationships. Friends and co-workers on the other hand demand a certain level of interaction and reciprocity for the relationship to be sustained [18, 57]. This paper addresses voluntary rather than kinship ties.

Not all ties are based on the same kinds of exchanges: work pairs who do not maintain friendship ties still collaborate on work, exchange work-related information and socialize, but do not exchange emotional support [26]; neighbors provide small services, while kin provide social support [63]; women at work receive social support and friendship from other women, and instrumental ties of communication and advice with men [28]; computer-mediated groups maintain weak ties based on group-wide, instrumental exchange, task-focused ties oriented toward production; and emotional support ties oriented toward interpersonal contact [23, 24, 25, 26]. Although combinations of relations may vary with the tie, the number of different types of resources pairs exchange increases with increasing strength of the tie. Although we may not be able to predict the types of exchanges, the number of them is likely to increase with increasing strength of the tie.

The bulk of the work on the strength of ties comes from studies of offline behaviors. Thus, in moving from what is known about offline ties to online ones, this paper makes these assumptions about ties and online exchanges. First, it is assumed that the *characteristics of ties hold in the mediated environments as they do in the offline environment*. Thus, online ties, like offline ties, are expected to be stronger to the extent that they demonstrate greater numbers and types of resource exchanges. Second, it is assumed that *online exchanges are as real in terms of sustaining the tie as offline exchanges, and online ties are as real as offline ties*. Although there has been little

detailed comparison of individual's online versus offline interactions, many studies find rich, multiplex relations to flourish online, including information exchange, social support, work and play [29, 31, 49, 52, 56, 64]. Third, it is fundamental to the argument presented here that the entire tie between communicators be considered, not just online behaviors. It is assumed that *it is the tie that drives the number and types of exchanges*, not whether the tie is maintained online, offline, or both (see [25]): face-to-face exchange may augment mediated exchanges *or vice-versa* (see [24]), with characteristics of exchanges dependent on the tie not the medium.

## Ties and media use

Earlier theories and approaches to computer-mediated communication (CMC) have been tacitly concerned with the types of social network relations communicators could maintain via CMC. Recognition of the "reduced cues" of the CMC environment, led to the conclusion that CMC was less appropriate or useful for emotionally laden exchanges, for the delivery of complex information, and for creating a sense of "being there," [9, 15, 17, 30, 51]. These conclusions effectively argue that the media cannot sustain certain kinds of exchanges and thus certain kinds of social network relations and ties, particularly strong ties. The "richness" sought in these communications is a richness in the types of exchanges: emotional and instrumental, simple and complex, verbal and non-verbal.

However, strongly tied pairs, with their higher motivation, eagerness to communicate, and desire to include more intimate and varied communications, manage to modify the "lean" CMC environment to support their needs. CMC users extend text-based media by incorporating variety and emotion into their exchange, e.g., using emoticons and acronyms [42]. They establish and follow CMC-specific rules of conduct (e.g., on how to format messages that give away the content of television shows, [1]); come to coordinated definitions of genres [66]; and engage in self-disclosure and emotional support between pairs and among members of whole online communities [27, 29, 31].

Such norms and standards of use are initiated and sustained by frequent interactors and reinforced by continued use [8, 10, 17, 66]. CMC "never are technologies whose design is fixed; instead the design continues to be developed simultaneously with their implementation and use" ([36], p. 300). In the social construction of media use, communicators determine the final form of their use, and more strongly tied pairs are most likely to engage in that social construction.

Since strongly tied pairs are motivated to communicate, they seek both *ways and means* of

expressing themselves. Strongly tied pairs are likely to use more means of exchange to satisfy both their *need* for frequent communication (e.g., to exchange time-limited information effectively among co-workers), and their *desire* to communicate (e.g., between friends who want to converse, provide support, or arrange meetings). Thus, friends among members of a co-located academic research group use more media to communicate than acquaintances, and formally tied work pairs in the same environment used more media than informal work pairs [26]; project team mates in distance learning classes used more media to communicate than other class members [23, 24]. One of the expected benefits of using more media to communicate, and being more proactive in seeking channels for communication, is that such ties will be more robust following changes in media. We can expect such communicators to re-negotiate their communication pathways, actively and mutually, if one means of communication disappears.

The strong motivation to communicate also suggests that strongly tied pairs may be quick to adopt a new means of communication, particularly if it fits a communication need not already satisfied by current media. A new medium may have a direct effect by improving communication processes and an indirect effect on the use of existing media. Lind and Zmud [37] found that the addition of voice mail to traditional written means of communication not only produced stronger customer-sales and sales manager-field representative relationships, but also resulted in an increased use of traditional media. The use of new media created a stronger tie, and thus a desire for more frequent communication, which was satisfied by greater use of all existing communication channels. This is in keeping with the notion that more strongly tied pairs will seek out more ways of maintaining and expressing their tie. This also supports the view presented here that observation of the *tie* is key to understanding media use patterns, and that it is necessary to examine all communication between pairs to understand the impact of new media.

What of weak ties? CMC provides access to a wider range of others to whom we are weakly tied, extending communication possibilities by crossing time and space, drawing in more peripheral communicators, and providing access to a wider set of contacts [7, 13, 46, 48, 53, 54]. The reduced cues of the CMC environment reduces individuals' apprehensions about contacting unknown (and unnumbered) others [53, 54]. Communication via email or bulletin boards can be achieved with low social overhead, and can reach a wide range of people within the network [7]. Both the reduced social overhead and greater reach make CMC an ideal means for initiating a weak tie.

By contrast with strongly tied communicators, weakly

tied pairs are not highly motivated to initiate interaction. They rely on few media to maintain their tie, and often only one; moreover, within a particular environment, they may all rely on the same medium [24, 26]. Because of their lower motivation, we can expect weakly tied pairs to be more passive in their contact with others (hence the attempts to design CMC that increases opportunities for informal contact, e.g., [15]). It is also likely that weakly tied communicators will wait for feedback via one medium rather than branching out to other media to seek a quicker reply. In turn, this leads to the expectation that weakly tied pairs will be slow to begin to use new media, and will not add many new media to their repertoire. Note that this does not mean *individuals* will not adopt a new medium, but they will not initially adopt it for communication with remote, little known, others. Their use is more likely to begin with those they know well, and with whom they are used to negotiating communication practices.

One of the downsides of using few media to communicate is that weak ties maintained via one medium are susceptible to change in that medium. For example, weak ties sustained through an email list can be disrupted if the list is no longer supported. Moreover, when all weakly tied individuals in a group or organization have maintained that contact through a single medium (e.g., a departmental meeting) the complete structure of weak tie contact is particularly susceptible to a change in that medium. This is discussed further below.

Thus, the effects of CMC can be seen to differ according to the strength of the tie between communicators. We can expect strongly tied pairs who find the medium insufficient for their needs to actively introduce changes to suit their exchange needs, and/or to expand to more media. On the other hand, we can expect connections between weakly tied individuals to suffer a greater impact from changes to their low overhead medium. With little motivation to maintain the tie, it is unlikely that they will go out of their way to recreate the tie in another venue. It is more likely that they will wait for the next low overhead medium to arrive and accept what weak ties it confers.

### Balancing strong and weak ties

Although much of the CMC research has focused on how to create and sustain strong ties, weak ties also play an important and beneficial part in overall information exchange and access to resources. While successful work endeavors require that individuals sustain an adequate frequency and variety of interaction with others, there is also a need for the group as a whole to remain connected. Weaker group-wide ties need to be sustained so that sub-groups remains focused on overall goals. Thus, for any

individual, there is a tension between maintaining strong ties with project co-workers, and weaker ties with the group as a whole.

The balance of strong and weak ties is particularly important when we consider access to resources. Tightly bound groups can become insular, responding only to resources circulating within the network. Those who are strongly tied are likely to show similarities in attitudes, background, experiences, and access to resources [43]. They are motivated to share information, and provide each other with early, frequent access to resources available *within* their social circle [21, 33].

On the other hand, weak tie contacts spend most of their time operating in different social circles and provide access to resources *outside* the close social circle [3, 20, 21, 43]. CMC can ease the difficulties strangers have with contacting individuals across hierarchical, geographical and organizational boundaries [7, 13]. For example, Sproull and Kiesler [53] report how a manager's broad email inquiry provided responses mainly from people the manager did not know, and who belonged to different units and locations within the organization. Such wide ranging exchanges are important for broadening an individual's knowledge base, exposing them to ideas and approaches different from their own, and increasing the ability to recognize and take advantage of new opportunities [6, 22, 32].

These studies show how individuals can change *latent ties* – ties for which the connection is technically available, but not yet activated – into weakly active ones. Latent ties can be formed by enrollment in an organization's internal email system, or by non-computer means such as invitation to departmental or unit meetings. Such latent tie connection mechanisms depend on structures that are established organizationally, not by individuals. Only by having this system available for access can such widespread latent ties be easily converted into weak ties. Thus, a medium such as email can be established to act as a diffuse, background contact mechanism, one that operates to connect the very weakest of ties, and which requires little work on the part of the individual to access the social network.

Thus, both strong and weak ties help in our daily work and lives, each providing access to different kinds of resources at different frequencies. This dual role of ties provides some explanation of the effects of new media. When a new medium supports the inclusion of more peripheral workers, it supports the growth of stronger ties with central individuals *and* may help bring new resources to the center. When it supports ongoing work and communication, it can increase the frequency and means through which strong ties can maintain their relations. Both effects produce integration with the whole. However,

when the new medium replaces an important existing means of communication, it is likely to have a disintegrative impact, and, as noted above, this effect may have its greatest impact on weak tie connections.

Overall, in any group oriented to production deadlines, there remains a tension between maintaining weaker ties for exposure to new information and stronger ties for task-focused behaviors, one that is likely to be reflected in overall patterns of media use. Near deadlines can be expected to narrow communicators' focus to strongly tied team mates, thereby decreasing involvement in group-wide communication. Although this narrowing of attention is necessary for completion of projects and attainment of goals of production, it does take away from group-wide involvement. Thus, in examining how ties interact with media use it is important to consider the impact of current temporal conditions (such as proximity of work deadlines) on interaction patterns and media use (e.g., [23, 24]).

### Development of ties over time

The discussion so far has considered ties in stasis, i.e., strong and seeking to stay that way, or weak and not seeking a change. However, ties are often in flux, particularly ties created and sustained around temporary work projects. Members of such groups come together for a limited time period during which they learn to work together, provide each other with work support and possibly emotional support, and achieve their goals. While much of the research on computer support for work groups focuses on the completion of tasks, other forces also come into play. McGrath [40] describes groups as continuously engaging in production (task related interaction), member support, and group well-being. Thus, within their work context, successful groups must come together and develop strong, multiplex ties: ones that include instrumental task-related behaviors as well as socio-emotional support behaviors.

Since groups rarely come together fully formed, their initial tasks include developing their ties and communication norms. Time-limited work groups demonstrate phases of coming together, resolving crises, refocusing, completing tasks and dissolving the group [4]. Each of these phases can have implications for media use (see [5] regarding group decision support systems), but can also be seen as phases in the development of social ties, which it is argued here also has implications for media use. Members of both ongoing and time-limited groups engage in a constant building and rebuilding of work and social ties; over time, ties are reinforced and renegotiated as exchanges are reciprocated or not, and as support and emotional relations are added or dropped.

At the same time that intra-group ties are being

constantly negotiated, conventions of group behavior and use of technology emerge through discussion and practice [8, 10]. It has been suggested that the reduced cues of the CMC environment may slow group development in computer-mediated groups [58]. This can have serious impacts on computer-mediated, time-limited groups, who often have to complete their tasks with the same kind of schedule as face-to-face groups. Such groups have to make extra effort to compensate for their environment, expending more effort to maintain ties at a distance than needed in a face-to-face environment [27].

We can also view the problem of group formation as that of individuals working against their normal tendencies toward weak ties. Time-limited groups who come together as weakly tied pairs need to expend effort normally reserved for maintaining strong ties, e.g., engaging in frequent communication, self-disclosure, and negotiation of communication norms. Effort is greater because individuals must change their normal weak-tie behavior (i.e., waiting for opportunities to interact), into pro-active, strong tie behaviors with all members of the group.

Building these ties will be easier with more frequent contact. Continued interaction allows the development of working and friendship relations. We come to like those with whom we communicate more frequently, and we include more social communications with others over time even via CMC [58, 59]. Thus, we are more likely to develop stronger ties with those with whom we have more continuous opportunities for communication. Indeed, Walther [58] found decision making groups with *continuous* access to CMC showed more intimacy and sociability in their interactions than did face-to-face groups that met intermittently, and progressively increased the social versus task orientation of their communications. Freeman [16] found that changes from awareness to acquaintance among 16 researchers were much more pronounced in the seven months after the introduction of a CMC system compared to the seven months before. Although Freeman cautions that other factors could have produced these changes, it appeared most likely that the opportunity for interaction afforded by the continuous CMC contact was responsible for speeding the process of mutual acquaintance. Thus, it may be infrequent contact, rather than CMC itself, that slows group development.

Time-limited groups eventually reach a phase when their production cycle is complete and the group is dissolved. Some ties may remain based on professional or friendship bonds, but others may dissolve as the motivation for interaction is removed. Ties based solely on work exchanges, however multiplex, are unlikely to survive the dissolution of their purpose unless renegotiated on the basis of a new or different reason for

existing. So, too, when the means for maintaining a tie is removed — dropping the group meetings, non-response from or deletion of a email list — ties must be renegotiated via different means, or left to lapse. Where the media still remain but the motivation for interaction is gone, ties may once more become latent, but perhaps may be more readily rekindled if the motivation returns, e.g., as new work groups are formed (see [45]).

## Which media?

In the preceding sections, it has been argued that strong interpersonal ties lead communicators to seek both the means and opportunities for exchanges that support their relationships. By contrast, those who are weakly tied depend on more passive means of communication, waiting for opportunities and using means that entail the lowest social overhead. We turn now to consider the media that support strong and weak ties, and the impact on network structures that may follow from changes in media. Questions that remain are: Which medium is likely to be used by the more weakly tied pairs? Where does this medium rank in the profiles of more strongly tied pairs? What is the impact of removing or changing this weak-tie connector?

## Media use by weak ties

To support a group-wide network of weakly tied pairs, whether that “group” is a community, organization, department, or work team, requires a means of communication that connects all or nearly all participants. However, we cannot say that because it is email that connects these pairs in one setting or in the past that it will be email in another setting or when another medium is added. The actual medium will depend on local conditions. Since weakly tied pairs are not highly motivated to engage with each other, and do not communicate frequently enough to establish their own group-wide patterns of behavior, the medium that serves to connect them is likely to be established by others. It is likely to be a managerial decision to initiate such a mechanism, whether that be group-wide face-to-face meetings (business or social), mailings, email announcements, or bulletin boards.

Traditionally, regularly scheduled face-to-face meetings provide opportunities for group-wide contact within organizations. Such meetings are called and organized by management rather than group members. But, as organizations make greater use of CMC and of distributed workers, new means of maintaining group-wide ties have become common: bulletin boards replace face-to-face meetings for group-wide communications [65]; online classes replace on-campus classes [22]. The

importance of group-wide, organizationally-established contact mechanisms is evident in two social network studies: one of a co-located academic researcher group [26] and one of classes of distance learners [24]. Face-to-face contact was important for the academic group, including scheduled meetings established for classes and research meetings, and unscheduled meetings occurring due to office co-location [26]. Webboard, a web-based bulletin board used for discussion and assignments, served as the main contact medium among all members of three distance classes, closely followed by Internet Relay Chat (IRC; a synchronous text-based Internet communication channel) used for “live” synchronous sessions. Weak ties among members of the fourth class were supported through weekly IRC sessions after the use of the Webboard was abandoned early in the semester. In each case it was the class-mandated media that connected the most weakly tied pairs [24].

Where the medium established by outside authorities does not fit well with task and interpersonal requirements, the medium may be resisted. Markus [38] describes an organization in which email was established as the organizational standard for communication, overriding the use of the telephone and face-to-face meetings. Managers imposed its use in accordance with the directive from the chief executive. However, when the executive left the company, email use declined and use of phone and face-to-face meetings were re-established. Similarly, Yates, Orlikowski & Okamura [65], describe an organization in which regular face-to-face meetings, which had been used as a general means of communication, were replaced by electronic bulletin boards. However, one group, which they characterized as more formal than others, resisted the use of bulletin boards and remained with face-to-face meetings for contact among their group members.

Resistance to use of a medium may be passive (e.g., non-use), or active (e.g., establishing and using other means of communication). Non-use is a more likely response among weakly tied pairs, with the consequent result that weak ties will be further weakened. Their low need to communicate, infrequent contact, and low social influence on each other, makes it unlikely that they will attempt to establish other channels for communication. As relatively unconnected individuals, they are more likely to look to supra-group norms for standards and means of communication. Their use of the medium may depend on their co-orientation and commitment to the group and its goals (see below regarding “Gripenet,” and support among participants in a strike). By contrast, strongly tied pairs can be expected to influence each other on which media to use and will be more able to sustain use of an alternate communication mechanism, as did the group members in the study by Yates et al [65]. Their need and

desire for contact is higher, and so they will strive to establish common patterns of communication. Moreover, their ability to influence each other allows them to carry on with their established means of communication even in the face of organizational change. Thus, patterns of adoption and/or resistance to new media can also be expected to vary with the type of tie maintained by communicators.

### Media use by strong ties

What media are the strongly tied pairs likely to use? Such pairs have the organizationally established medium available and their desire to communicate would suggest that they would use it and manipulate its use to serve their needs. If their ties have been strengthening over time, then this medium will have been their first contact mechanism and one that they are accustomed to using. Then, if other means of communication are available, they may explore using these media to carry out their different kinds of exchanges, and perhaps to increase their frequency of interaction. For example, a weekly face-to-face or online discussion is unlikely to serve the needs of those who work together daily. Such pairs may turn to ad hoc face-to-face meetings that provide immediate feedback, or email exchanges that provide the convenience of asynchronous communication. The key here is that the needs and desires of the communicators, as established by their tie, drive the use of media and the inclusion of new media in their repertoire.

Results from the network studies mentioned in the previous section lend support to the notion that more strongly tied pairs continue to use the group-wide medium and add other media according to their needs. For the academic group [26], Guttman scaling indicated a uni-dimensional hierarchy of media use, with pairs using face-to-face unscheduled encounters when only one medium was used, adding scheduled meetings as the second means of communication, and email as the third, with other, more rarely used media such as the telephone, fax, and videoconference added after these three (378 pairs; Guttman coefficient .92, indicating 8% error and accepting 10% error as confirming a uni-dimensional scale). For each of the four distance classes, email exchanges and infrequent telephone use were added to the class-mandated media by those with stronger ties, with the frequency of contact via email increasing with increasing strength of the tie [24].

Thus, we come to the conclusion that within a group, an organizationally established and possibly mandated means of communication serves as a *base* for initiating and maintaining group-wide ties. The presence of the medium provides the very weakest of connections among group members, but does provide a means through which

individuals may activate *latent* ties into *weak* ties. The lower the overhead in terms of technical know-how or social exposure, the easier it is for individuals to use the medium to activate and maintain weak ties. More strongly tied pairs will also make use of this medium, but their greater variety and frequency of exchanges will lead them to seek out other means of communication to use *in addition to* the base medium according to the needs of the communicating pair. Where such strong ties develop over time, the base medium may also be seen as a way to initiate weak ties that may provide the means for a tie to develop and lead the communicators to seek further means of contact. Thus, the base medium serves as a potential connector of latent ties, an actual connector of group-wide weak ties, and an initiator for stronger ties.

Overall, these observations lead to these conclusions regarding tie strength and media choice: that weakly tied communicators will depend on the primary, organizationally-established or mandated medium as their means of contact; and that more strongly tied communicators will use the primary, organizationally established or mandated medium as a *base* on which to build their communications, augmenting their media use in keeping with their communication needs.

### Changing the base communication channel

Changes in the base medium can be expected to have a greater negative impact on weak ties than on strong ties. As argued above, the dependence of weak ties on one common medium puts the network of weak ties at risk if that medium is changed. Although such a change will be disruptive for strong ties who use this medium as a base, their use of other media makes it possible for them to continue communicating. A new, base medium will also have an impact as it initiates connections among individuals who previously were not in contact. Thus, we find early literature on email describing how the greater reach of email and simultaneous addressing forged connections between center and periphery [12, 14, 31, 47]. CMC also forges pathways among peripheral players. Thus, an employee email "Gripenet" can emerge, connecting formerly disconnected others in discussion of their dissatisfaction with organizational practices [11]; women in a large corporation can come together through email to form a career discussion group [67]; and professors from several universities can set up an email network in support of their strike activities [50].

Change in the base medium can have differential impact for weak and strong ties. Those communicating through only the base medium lose connections made through the discontinued medium and must reconstruct ties through the new medium. Strongly tied pairs need only shift their communication patterns, with other

channels continuing to connect them while the transition is made. This also suggests how adding or subtracting a particular interaction, i.e., interaction via a particular medium, can change coordination among actors in the network. By subtracting interaction via a group-wide communication mechanism, ties and coordination among weakly tied pairs are dissolved, yet ties among strongly tied pairs continue. This also shows how a computer network, as a social network [64], can enable and disable interaction between two parties: the introduction of a new group-wide communication mechanism can connect otherwise separated individuals (whether separated by geography, hierarchy or status), and similarly, the removal of that mechanism can disconnect otherwise weakly connected individuals.

Differential effects of the addition of new media for weak and strongly tied communicators also offer another interpretation of the debate on whether new media "replace" or "extend" communication possibilities. For weakly tied communicators, a new, group-mandated medium will indeed replace an old one, e.g., shifting communications from face-to-face to email or bulletin boards. This in turn *replaces the existing weakly tied social network with a new one*: one network is dissolved and another formed. The most weakly tied pairs who depend on the use of only one medium will be the most susceptible to change. Even when the medium is not a group-mandated medium, any change in connectivity among such weakly tied pairs will impact the size and composition of their network. On the other hand, a new medium is likely to extend communication among strongly tied communicators, *reinforcing the existing strong tie network*.

The impact of the shift in networks will differ by setting, but any mass re-organization of ties can be expected to have impacts on who talks to whom. One type of change that has been identified as a result of the introduction of new media is a shift in power from a hierarchy of position to a hierarchy of competence [2, 17]. The introduction of new, organization-wide media, and particularly the introduction of CMC that can reach across unit, departmental, and organizational boundaries, can change structural dynamics among people, creating central figures who supply new types of information while displacing others, and forming new social networks while dissolving others [2, 47].

### Conclusion

This paper has argued that tie strength, a linear phenomenon ranging from weak to strong, has a non-linear effect on social networks supported by CMC. Weakly tied communicators, due to their low motivation

to communicate and low influence on each other's behaviors, are most likely to rely on an organizationally established, low overhead, medium for communication, accepting the group-wide connectivity it provides. By contrast, strongly tied communicators will use the organizationally established medium as a base on which to build their multi-media communications. They will adapt their use of media to support the greater range of expression important to their relationship, as well as use multiple means of communication to support their tie. They will be more ready to adopt new media that suit or complement their communication needs, and more able to influence each other to resist a change when it does not suit their mutually agreed patterns of communication.

An organizationally established, wide-reaching medium can provide the means for as-yet-unactivated latent ties to be activated into weak tie relationships. However, ties based on the use of only this medium are particularly susceptible to dissolution when those means are changed, as is the weak-tie network this medium sustains. Strong ties, based on many roles, relations and media can be expected to be more robust under conditions of change. Change in the base medium impacts only one of their means of exchange, and the addition of a new medium may further strengthen their ties where it provides new facilities for communication.

The differential impacts on weak and strong ties arising from changes in media suggest a need to plan for such effects when implementing new media. To maintain connectivity among both the strongly and weakly tied members of a group requires implementation of a means of communication that reaches all group members, yet requires little effort or extra work from them when receiving or contributing group-wide communications. At the same time, sub-groups organized around work or other activities require more means of communication. Members of these closer groups require media that can be tailored to fit their specific tasks and schedules. Some evolution in use can be expected over time, particularly among strongly tied communicators as they develop norms and uses of media that accommodate their schedules and work activities. By providing multiple means of communication to groups, members can use these means to build the media array that best serves their communication needs and desires.

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