Filter Effects of Mediating Technologies

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Abstract

Mediation technologies like phones and IM can be viewed as filters on communication. The present study investigates which conversations are filtered and which are not by recording conversations in an office environment and later asking the workers to indicate which utterances would have been initiated over phone or e-mail if they were not co-located. The results indicate that 76% of all conversations would be filtered. It is argued that the filtering would be perceived as positive due to less disruptions in a telework setting, but that the long term effects would be negative. The filtering is explained by three mechanisms involving behavioral cost, memory and social cost respectively.

1 Introduction

Telework or distributed work has become increasingly widespread (Akselsen, 2001), moreover, recent research suggests that it increases both productivity and the workers' quality of life (Hopkinson, James & Maruyama, 2002a; Akselsen op cit). The main reason given for increased productivity is less disruption (Hopkinson, James & Maruyama, 2002b). This seems to be at odds with a long research tradition that points to the importance of informal office chat and informal meetings to productivity, knowledge distribution, innovation and the social well being of office workers (Wynn, 79; Suchman & Wynn, 84; Kraut, Fish, Root & Chalfonte, 90; Fish, Kraut, Root, & Rice, 93; Whittaker, Frohlich & Daly-Jones, 94; Isaacs, Whittaker, Frohlich & O'Conaill, 97).

Mediating technologies can be viewed as filters of communication. The cited telework studies suggest that filtering is positive (less disturbance), while the "office chat" studies argue that it is negative in the long run (less chat leads to less collaboration and innovation). The present study addresses this issue by investigating which conversations are filtered and which pass through mediating technologies.

2 Method

The study was done as naturalistic observations in an office environment divided into cubicles. Each cubicle was shielded with lightweight, movable walls about 1.5 m high. The work consisted of error recovery and planning of expansions of a telecom network. The workers belonged to different departments, but knew each other well and were experienced in their work. Five to eight workers occupied the office. All of them could overhear speech in a normal voice. The observations were done in intermittent sessions of two hours within a period of two weeks. Altogether four sessions were conducted. The first phrase of all conversations was literally

registered together with context information and time of occurrence. A total number of 79 utterances were registered; of these 11 were uttered by visitors and taken out of the analysis, leaving the total at 68.

After each session the workers were asked to identify which of the recorded conversations would not have taken place if the workers had not been co-located. Specifically, they were asked to state which utterances signified a conversation that would have resulted in a phone call, or other type of contact (non-filtered utterances), and which would not (filtered utterances). Phone and e-mail were explicitly mentioned as communication technologies that could have been used. Lastly, the utterances were analyzed and classified with regard to what effect, if any, they had on the work.

3   Results

According to the workers 52 of the 68 utterances (76%) would have been filtered in a telework setting. In a telework setting the 16 non-filtered utterances would have been directed to only one recipient. Assuming the utterances would have been distributed uniformly among the 6 workers, the number of conversations per worker would be about 2.5. This represents a 30-fold reduction of overheard conversations in a telework setting compared to a co-located one.

The 68 utterances fell into four main categories with respect to effect on work:

- Problem solving. This category includes utterances that give or ask for assistance related to specific tasks. Example: "What's the public code for this city?", "Does somebody know where the caps lock key is?"
- Information distribution. This category includes utterances related to personnel location and the status of key applications and office facilities. Examples: "The head quarter is jammed, I think.", "Mr. D has phoned you several times."
- Work coordination. This category encompasses task delegation and task prioritization. Examples: "Where is Peter – can somebody take care of this …", "Did you manage to solve his problem?"
- No immediate effect. This category subsumes utterances that have no discernible effect on work. Example: "Look, it's raining."

A post hoc analysis indicates that different conversation-categories are filtered differently (chi square = 16.99, df = 3, p <=0.001). As shown in table 1, work coordination is filtered least with 44%, problem solving next with 59%, information giving is filtered 71%, while all conversations with no immediate effect would be filtered. Of the 40 utterances with effect on work, 24 (60%) would have been filtered.

Table 1: Utterances by category and filtering

	problem solving	information giving	work coordination	no immediate effect	total
non-filtered	7	4	5	0	16
filtered	10	10	4	28	52
total	17	14	9	28	68

4   Discussion

The discussion will be focused around two themes, the effects of filtering and the reason why filtering occurs.

4.1   Effects of filtering

The results indicate that a telework setting would lead to a dramatic reduction of overheard conversations, and consequently a considerable reduction of disruptions. Thus they are in agreement with early studies of communication frequency as a function of distance (Kraut et al. 90) and with studies citing less disruption as a positive factor in making telework an effective way of work (Hopkinson et al. 2002b). However, a large amount (60%) of information *relevant to job performance* would also be filtered in a telework setting. It is prudent to ask what effect this would have on work performance.

Competent workers behave rationally. They know what is important to convey to others and they know when they need help. Thus the conversations that are filtered are probably the conversations the workers have deemed "unimportant" for the work at hand. This is indicated by the fact that all conversations without discernible effect on work would have been filtered, and a further analysis of the results supports this. For instance, in the "problem-solving" category the filtered questions could easily be replaced by other sources of information. This would require some extra effort by the problem solver, but this extra work would be measured in minutes and seconds. Consequently it would never show up as a significant factor in an analysis of work efficiency. The same holds, to even a larger degree, for the two other categories, "information distribution" and "work coordination". Thus it is hard to see an immediate negative impact on work performance as a result of the reduction in number of conversations.

The long-term effects of the reduced communication are harder to assess, but probably negative. This conclusion is based on an analysis of the "implied information" the conversations supplies. "Implied information" means information that can be assumed to be true given the utterance and the listeners knowledge of the context. The following filtered utterances exemplifies this:

- A question, overheard by everybody: "Tom, - Black Village?" Without hesitating Tom replies a two letters code. There is no introduction, no further explanation or closing comments. Apart from solving a problem for the questioner, this makes everybody in the office aware of the questioner's current tasks and field of work and Toms expertise in another.
- Bob tells Ann "I've just received the task you asked for". Earlier Ann, being part of another unit, had predicted that the task ought to come up. Bob's utterance shows that he understands that Ann was concerned, that he can be relied upon to offer this information and confirms their understanding of the workflow.
- Without any plausible occasion, Don says: "I really need to know more about the new services we are offering". Apart from saying just what it says, this utterance also makes the others aware that Don's work and the new services are related in some way, that Don doesn't feel quite up to it and probably shouldn't be given more new tasks at the moment.
- The utterance: " The head-quarter is jammed, I think", leads to an exchange on work routines and workflow strategies. This adds to their mutual understanding of how the company is functioning.
- Tim utters: "Nora, I really need a break now". The obvious message is that Nora must take the phone and that Tim is in the lounge if someone needs him. It also tells the others about

Tim's habits, when he needs a break, who he hands things over to and that he doesn't just sneak out.

As these examples show, the utterances provide implied information on a whole range of subjects; on workflow, on field of knowledge, on habits, on level of competence, on current tasks and so on. In other words, these conversations are both a means with which co-workers learn to know each other and a vehicle for expanding each other's knowledge of how the company works.

When work follows a pre-planned course, this type of knowledge is more or less redundant. It shows its importance as soon as work deviates from course. To do problem solving and diagnostics the worker needs a good model of the work possess, knowledge of who could be relied upon to have useful information, information on which resources are available where, and so on. Just the type of information the filtered utterances contain. The results don't shed light on this, but it seems a safe bet that implied information is the richest source of this type of information. Thus it is reasonable to assume that in a telework setting, office workers will omit to convey information that is important for the long-term conduct of work.

4.2   Why is communication filtered?

In the late eighties and early nineties much interest was devoted to video as a means of informal workplace communication (Kraut et al. 90). One argument for video was that the sight of others functions as a trigger for communication (op. cit). When the effect of video on communication frequency later was found to be less than predicted, it was argued that the behavioral cost associated with use of communication technology reduced its potential as a mediator of informal communication (Fish et al. 93) Echoing these ideas we propose that mediating technology filters communication by three different but intertwined mechanisms:

1. Behavioral cost. This hypothesis states that when the behavioral costs involved in communicating overshadows the perceived gains, the conversation will not be started. Thus, conversations about themes that are deemed as unimportant will occur only when the cost associated with talking is minimal. Under normal circumstances talking face-to-face has the least associated cost, while the cost associated with a phone call involves both finding and dialling the number, waiting for an answer, introduction of one self, etc. The question "Tom – Black valley" is filtered primarily by this mechanism.
2. Memory cue. This hypothesis states that initiating a conversation presupposes a reminder. In some circumstances this reminder is the physical sight of the other person, thus physical proximity has other filter characteristics than for instance e-mail or phone. The utterance: "Did you manage to solve his problem" is primarily filtered by this mechanism.
3. Social balance. This hypothesis states that there ought to be a balance between the importance of the theme introduced in a conversation and the task that is interrupted by the conversation. In a face-to-face setting the initiator of a conversation is able to gauge the listener's tasks. If the prospective conversational partners are physically separated, the initiator has to guess at the listener's task. Thus to place a phone call requires a theme of higher importance than an e-mail. The utterance: "I really need to know more about the new services we are offering", is probably filtered by this mechanism. In the co-located situation it is said into the air, and no one feels pressed to comment. As a start of a phone conversation or as the message of an e-mail, the utterance would have taken on a much higher significance.

The hypothesised mechanisms indicate that the speaker (consciously or unconsciously) relates the assumed cost and benefit of mediated communication to the assumed cost and benefit of non-communication. It is highly probable that it is the overt message that will be evaluated, not the implied information the message conveys. Thus, as long as implied information accompanies unimportant overt messages, it will be filtered whether it is important or not.

5 Summary and conclusion

The results indicate that mediating technology filters communication between co-workers to a large extent. This is positive in the sense that distributed work is a lot less prone to interruptions and disturbances. We have argued that the reduction in communication also is negative since the filtered information is important for the workers' ability to cope with unforeseen work circumstances. In order to explain why some, potential, important information is filtered, hypotheses concerning behavioral cost, memory and social cost have been put forth. Together with the implied nature of the filtered information, they can explain why filtering occur.

Clearly what we want is mediating technologies that filter disruption but let important implied information through. Such technology must both be able to convey information on colleagues, their work, field of expertise and habits, and at the same time do this in a manner that doesn't require or demand conscious attention. Specification of such mediating technologies requires a thorough understanding of both filter mechanisms and the role of implied information in the workplace.

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