



E-mail as Habitat

An Exploration of Embedded Personal Information Management

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E-mail and Personal Information Management

E-mail has become more like a habitat than an application. It is used for a wide range of tasks, such as information management, and for coordination and collaboration in organizations. Our research shows that e-mail is not only the place in which a great deal of work is received and delegated, it is also increasingly used as a portal for access to online publications and information services. It has become the place where personal computer (PC) users spend much of their work days (the application is always on and is often the focus of attention). Moreover, the burgeoning quantities of messages and attachments that e-mail delivers to people each day has led users to co-opt it as a personal information management (PIM) tool. In fact this simply follows from what we have found to be a common tendency of knowledge workers, which is to embed

personal information management directly into their favorite workspaces.

In this article, we further explore these new and unanticipated uses of e-mail and suggest potential design ideas to better support them. We present the findings from four months of field work conducted at three companies and ensuing analysis during which we confirmed and expanded some of our earlier intuitions about the use of e-mail as a PIM tool. We conclude that e-mail is definitely overloaded, but also that this phenomenon depends on factors such as a user's role and the nature of their workplace.

A Field Study

Preceding the work reported here, extensive field work on PIM and e-mail was conducted in a series of studies. We conducted more than 60 formal and informal interviews with PC users in professions ranging from the creative



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arts to business and administration to scientific (including site visits, face-to-face interviews, and phone surveys in the USA and UK). From this research, one of the authors, while designing a prototype information management tool, observed the following about e-mail for PC users:

- * Many people use e-mail throughout the day
- * E-mail is the major means of non-face-to-face communication
- * E-mail is now the main means of document exchange
- * E-mail is co-opted by its users for many information management functions, such as to-dos (by marking up or resending oneself messages) and contact management (by sorting by name and filtering)
- * E-mail is overloaded, providing inadequate support for certain tasks it is rou-

tinely used to accomplish.

Curious about these findings, we decided to gather more detailed information about current information management behaviors of e-mail users. To obtain three different organizational snapshots of well-evolved e-mail practices, we conducted 28 interviews at three organizations that have experience with e-mail (the names of the last two organizations have been replaced with fictitious ones):

- * Xerox PARC, a large, established research center where the authors work. PARC has about 400 staff members in one building on a small Xerox campus in Palo Alto, California. Most employees belong to an approximately 5- to 10-person group in one of six labs. Researchers conduct mainly intra- but also some cross-lab projects, which may be more or less commercially oriented. Each employee

has a private office, generally located near the rest of his or her group (10 interviews).

- * MediaWorld, a 150-person, rapidly expanding, multimedia production company that produces animated content for Web sites. MediaWorld employees are divided into many different types of groups, including writers, artists, animators, engineers, Web designers, quality control specialists, and marketers. The offices are open-plan and spread over two buildings on the same block in San Francisco; people are located near members with similar roles (12 interviews).
- * LeadDesign, a six-person, design consulting firm working typically on shorter projects. Not all employees are full-time; two spend a considerable amount of time working on private projects for other clients. Their skills in graphics, HTML, and Web programming are targeted toward corporate image and Web design. Although they share office space, they often work remotely and often collaborate with their clients remotely (six interviews).



What We Did

Drawing on earlier research, we designed a loosely structured questionnaire on the uses of e-mail for PIM and work processes. We conducted the interviews at the workplace of each of the interviewees and asked them to show us the contents of their e-mail to illustrate their answers. We asked them a series of specific

questions for background information and then about e-mail. The questions about e-mail were developed from findings in the previous, more open-ended research on personal information management and the role of e-mail mentioned earlier.

The entire proceeding was video recorded and, when possible, we tried to use the camera to capture the details of the interviewees' folder organization and the general organization of messages. We also digitally photographed interviewees' workspaces and some surrounding areas (to document something of their opportunities for face-to-face communication).

Each of the tapes was transcribed and photos and images inserted into the transcript. We collated the results using various qualitative and quantitative analysis methods to understand the data. Some of the results of these analyses are presented in the following subsections.

What We Found

The individuals in our sample are fairly experienced in their profession on average (eight years) with extensive e-mail experience (11 years on average), but it is interesting to note that they are relatively recent users of their current application (three years). The range of either incoming or outgoing communication volume is extremely wide, from three to 100 messages per day (incoming mean, 42 and median, 40; outgoing mean, 17 and median, 12). For these people, e-mail has definitely become a to-do list; 72 percent of our respondents send reminders to themselves and 83 percent leave messages in their inbox as reminders.

Folder Organization and Finding: What is Efficient?

Recently Bälter [1] published a study suggesting that extensive and deep filing of e-mail is not as efficient a use of time as a flat and simple file structure with only a few folders (fewer than 30 folders depending on various factors). This is because the time saved on searches is outweighed by the time spent filing. Still, this doesn't seem to stop some peo-

ple from gradually accruing increasingly complex filing schemes for their e-mail as time goes by. The complexity of the filing structures used varies greatly, from only one inbox to more than 400 folders! The mean number of folders was 90.8 (with a median of 27, just under Bälter's limit). But we found that, even after accounting for age and job experience, a correlation exists between greater e-mail experience and increasing numbers of folders (with a Pearson's correlation coefficient of .438 and significance of 0.022). Does experience really lead to greater inefficiency?

We found that folders tend to be organized by one or more of the following criteria, and the proportion of each varies immensely between e-mail users:

- * Sender: either a person or a distribution list
- * Organization: for example, a client or a professional body
- * Project: a coordinated effort or a contractual undertaking
- * Personal interests: either professional or private

It seems plausible that grouping related e-mails is considered useful in preserving meaningful context for historical communications and activities and is not simply a strategy to support finding information at a later date. However, further observation is required to fully understand how folders are used in this respect.

Conversely, we found that folder hierarchies are generally shallow, with a typical depth of two levels. Users gave the following reasons for the lack of depth:

- * Scrolling or clicking down is generally a hassle. ("I just want to toss things in there.")
- * Users want recent or frequently accessed items to be easily accessible, and it is hard to keep track with deep folders. ("Some items I want accessible all the time." "A cache of recently accessed messages would be nice.") Nesting leads to the risk of losing content and possible duplication.
- * Some nesting seems to be merely a reaction to limited screen height, since users want to keep certain elements vis-

ible while they inspect others. Without nesting, some elements would inevitably scroll off the top or bottom of the window at times. Two levels of nesting seem to be adequate to manage screen space for this purpose.

The authors suspect that users could easily work with much longer listings of folders than the typical 50 or so that even a large computer monitor can display, since visual scanning of an alphabetically ordered list will likely be faster than clicking with the mouse.

Overall, users want immediate access to information, which limits the depth of a useful filing structure.

According to Bälter's theory, many people might improve efficiency by changing their filing structures, but this proposal overlooks the long-term legacy effect of managing stored

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messages and e-mail folders over periods lasting many years in practice. We found that quite a few folders are redundant, no longer in use (such as old project folders), or simply the result of eventually running out of convenient screen space (such as "EvenMorePeople" in one person's "People" folder). Bälter's model overlooks the effort that would be required to continually optimize meaningful filing structures, as a user's needs, directed by active contacts and projects, continually change, probably in unforeseeable ways. This may partly explain the correlation between length of e-mail experience and increasing numbers of folders. A realistic model of efficiency in managing folders should probably therefore take into account how many active folders are being used and how, not just the total number together with filing time and search time.

The interface can also be a source of headaches for users during filing. Indeed, all of the e-mail clients used by our interviewees enforce an alphabetical ordering of folders,

whereas many users would prefer to re-arrange some folders according to other criteria, such as frequency of access or priority. As a consequence, many users have developed workarounds, such as naming an important folder “AAAA_ImportantProject” to bump it to the top of the alphabetical list.

Surprisingly, few users report much use of the search feature of their e-mail client; on the contrary, however, almost all respondents say they frequently use the sort feature. Once again, our findings differ from Bälter’s theo-

ing that either filters need to be simpler to use or that they are not that useful. In support of the latter hypothesis, most of our 28 interviewees consider that two-thirds of their mail volume would be impossible to filter automatically. The 40 percent of our respondents who do use filters say they use them mainly only for simple filing, for example, grouping messages from distribution lists. This simple kind of filtering approach depends on a folder scheme that corresponds to unique sender or recipient e-mail addresses



retical assumptions about retrieving messages, in which sorting is not considered. The sort feature appears to be more popular than search because it can be used to more quickly specify search criteria (such as date, sender name, subject, and size, and, in some cases, attachment, priority, and flag). Opening a search tool and typing criteria is much slower and thus less efficient. Indeed, some of our interviewees have not even explored the search capability of Microsoft Outlook, by far the most common mail tool among our interviewees.

Filtering Doesn’t Work for Everyone

Most of our users (17 interviewees, or 60 percent) say they don’t use filters. Several simply haven’t figured out how to use them, suggest-

ing that either filters need to be simpler to use or that they are not that useful. For example, messages from friends and colleagues or from distribution lists are easy to filter into dedicated folders. As a result, users with filing schemes based on sender are thus more easily able to filter a greater proportion of their e-mail. Other users must make complex decisions that filters cannot, in order to match messages to folders by organization, project, and personal interest.

Another problem with filters in Outlook may be that new mail that has been filtered is too easy to miss. Most of our interviewees prefer to have all their new mail in one place, and we would not be the first to suggest that automatic filters should be offered as an option after reading and not simply applied on receipt as in Outlook and Eudora.

Choice of an E-mail Client ... Not!

For 38 percent of our respondents, an e-mail client is not chosen but rather imposed by the organization they work for. Moreover, when given a choice, 10 percent of our respondents selected an application simply because it was the most used at the time, and another 10 percent because it was the application they used at a previous employer (possibly also imposed). We found the amount of external (environmental or organizational) pressure exerted on users quite striking: In more than half of the cases, an e-mail client is not chosen individually or rationally, despite the wide variety of clients available. This arbitrariness, together with the legacy effects (for example, Outlook e-mail files are incompatible with other mail applications), certainly has serious implications for designers trying to engineer new e-mail clients, hoping to attract individual users with their features. Institutional inertia may very well make such a plan fruitless.

E-mail as “FTP” and a Group Information Management Tool

We were not surprised to find that e-mail is now a central medium for document exchange. All but one of our respondents use e-mail to regularly exchange files. Some people sending attachments sometimes go so far as to say that they “FTP the document to someone,” which shows how e-mail and file transfer have now become blurred to the point of confusion.

Still, many e-mail users point to the limitations of the medium for file transfer: There is no version control, and attachments clog the inbox and can be hard to download over dial-up links when working from home—but these limitations don’t prevent anyone from doing it anyway. This seems to be due to what we call “embedding.” Exchanging documents is not a standalone activity; it is part of a wider context of exchanges aimed at accomplishing tasks. Communications form the context of

document exchange; it is natural then that documents get included in them, instead of requiring a switch to a different application detached from the flow of communication such as a Web-based document management tool.

Document exchange is generally linked to meetings—both before and after them. Many of our respondents send agendas through e-mail (65 percent) or actions (69 percent) through e-mail. More formal items, such as minutes, are less frequently used (38 percent),

perhaps because few people are now interested in taking minutes (a traditionally menial role, which reduces the ability to participate in the discussion). Interestingly, e-mail is now also used as a medium to provide a record or possibly some accountability; 76 percent of our respondents say they document activity via e-mail.

As one of them mentioned, it is important to “maintain a paperless trail.”

E-mail is also a major medium for organizing and scheduling meetings (80 percent of our respondents use e-mail for these two activities). The integration of calendar or scheduling features in e-mail clients such as Microsoft Outlook is generally appreciated. Indeed, many people point to the difficulty of managing schedules in the e-mail channel alone.

If e-mail is used to assign responsibilities to others (79 percent of the respondents) and make decisions (72 percent), it is much less used for voting on specific issues; only 38 percent of our interviewees use it to conduct polls. As we analyze in detail elsewhere [3], lack of polling is probably due to the particular nature of the work processes people manage in e-mail; their dynamic and fluid nature makes using formal polls an inadequate decision mechanism.

Factors Influencing the Use of E-mail as a PIM Tool

Our data showed some slight correlations implying that managers tend to receive more

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messages, have deeper hierarchies, and have a tendency to use filters and the search feature more often than other users. These correlations between status or occupation and quantity and organization strategies, though weak, are consistent with the findings of other researchers in the field.

Conversely, we found strong correlations between role and two other variables: Managers make more use of e-mail to distribute agendas and they document more of their activity via e-mail. Because managers must be more formal more than nonmanagers, and because they are generally meeting organizers, their e-mail usage seems to reflect these differences.

We did not find that having experience with a particular application influenced e-mail use. But general experience with e-mail is a significant factor (even accounting for age and seniority). First, having experience leads to what we called the addiction effect: The more experience people have with e-mail, the more frequently they check it, sometimes even during meetings. It also leads to a higher incidence of organizational activities in e-mail, such as organizing meetings and documenting activity. Finally, experienced users are less likely to succumb to organizational pressure over the choice of their application. We already discussed the fact that experienced users tend to use more folders than other users.

The organization and space in which e-mail is used also seem to influence usage. For instance, e-mail is infrequently used to organize meetings at MediaWorld. This could well be because scheduling in e-mail is awkward and the space at MediaWorld is open-plan—collaborators are clustered and can see and talk to one another easily. We often saw people opportunistically ask if others were free

as they spotted them passing or stopped by someone's desk. At PARC almost everyone has a private office, making it harder to catch people when they are around.

We noticed, though, that even when collaborators work in plain sight of one another as in MediaWorld's open-plan spaces, they still send each other a good deal of e-mail. So it seems that there are qualities of the medium that make it a preferable mode of communication for some purposes. For example, sending links and electronic copies of documents is impractical in a typical face-to-face encounter.

PARC is the only organization at which e-mail is reported to be used during meetings, which is certainly due to the prevalence of laptops in the organization. PARC also had a much lower incidence of assignment of responsibilities; this reflects earlier studies of research and academic environments in which collegial relationships are generally the norm. Activity was less frequently documented at LeadDesign, reflecting the smaller, more informal nature of a young company. Broadcasting at LeadDesign was also low, which is not surprising because all of its employees occupy the same room and often see each other all day long. By contrast, at the two larger organizations (PARC with about 400 people in an 80,000-person international corporation and MediaWorld with 150 people in two adjacent buildings), broadcasting is the norm.

The nature of the organization also influences the way people organize their e-mail messages in folders. The first-level organizational paradigm at PARC is organization by project, which seems to correspond quite well



to the activities of a researcher. At MediaWorld, content is mostly organized by department. This reflects the production-oriented nature of this organization and its clear role distinctions. Messages at LeadDesign are mostly divided between personal and professional content; this probably reflects the blurring of personal and private lives that is often observed in small, entrepreneurial structures.

Conclusion

E-mail is often described as “the killer application of the Internet.” According to our research, we think it is possible to be even more emphatic: E-mail is a serial-killer application! It is seriously overloaded and has been co-opted to manage a variety of tasks that it was not originally meant to support. The main reason for this phenomenon is, we think, embeddedness. Communication is a central part of organized work. Consequently, as e-mail captures an increasing share of an organization’s total communication volume, individuals progressively appropriate their e-mail client as a habitat in which they spend most of their work day. The network effect ensures that this tendency is infectious across a community or organization. Thus, personal information management is then embedded where it is most needed and accessible, that is, in the knowledge workers’ new electronic habitat: e-mail.

We believe our findings have several implications for anyone interested in building the next generation of e-mail clients.

- * First, definite possibilities exist for improvements to the user interface. To better support the use of e-mail as a PIM tool, organization of folders should be more flexible. Because users mostly work with ephemeral information, a cache of recently accessed items could be useful. The management of to-dos and reminders within e-mail should be supported; Microsoft Outlook is an example of a possible approach, but few of its extensive features were used (or even known) by our interviewees, suggesting that many improvements remain to be made.
- * Second, because e-mail is a major con-

duit for document exchange, incorporating some document management features inside the e-mail client would make sense. Users would certainly appreciate the tracking of document revisions.

- * Finally, our research raises an interesting design question: Would it be possible to leverage a model of users’ roles and organizational environment in the design of e-mail clients? One possible way would be to present a different interface, with different e-mail management options, depending on a user’s role. For a manager, scheduling and tracking of activities would be prominent, whereas for someone doing collaboration-intensive production work, document or file management would

Definite possibilities exist for improvements to e-mail client user interfaces.

be at the forefront. But these are only tentative examples, and certainly other possibilities exist. With the changing nature of e-mail and the factors influencing its use outlined, much room remains to engineer practical solutions incorporating these factors.

Further Reading

Previous research has foreshadowed some of the observations made here. For further reading on the subject of e-mail and information management, we recommend the following references:

- * Mackay (1988) was one of the first researchers to observe that e-mail is more than just a communication system, supporting time and task management.
- * Whittaker and Sidner (1996) describe the role of e-mail as a coordination and collaboration tool in an organization and the problems that arise from trying

to organize large quantities of incoming messages in a message filing system.

- * Bellotti and Smith (2000) observe the central role of e-mail in personal information management, with users appropriating features of their tools to create embedded mechanisms to manage complexity.
- * Segal and Kephart (1999) suggest that automatic filters should be offered as an option after reading and not simply applied on receipt.
- * Mintzberg (1973, 1979) has written extensively on the subject of the nature of managerial work and the structure of organizations. His work supports some of the hypotheses we have proposed about differences in observed patterns of e-mail use between managers and other workers, and between organizations.

References

1. Bälter, O. A keystroke-level analysis of e-mail message organization. In *Proceedings of CHI 2000*, pp. 105–112.
2. Bellotti, V. and Smith, I. Informing the design of an information management system with iterative fieldwork. In *Proceedings of the Conference on Designing Interactive Systems*, 2000, pp. 227–237.
3. Ducheneaut, N. and Bellotti, V. A Study of E-mail Work Processes in Three Organizations. Draft report available from the authors, forthcoming.
4. Mackay, W. More than just a communication system: Diversity in the use of electronic mail. *ACM Transactions on Office Information Systems* 6, 4 (1988), pp. 380–397.
5. Mintzberg, H. *The Nature of Managerial Work*. Harper and Row, New York, 1973.
6. Mintzberg, H. *The Structuring of Organizations*. Prentice-Hall, Englewood Cliffs, NJ, 1979.
7. Segal, R. and Kephart, J. MailCat: An intelligent agent for organizing e-mail. In *Proceedings of the ACM Autonomous Agents Conference* (Seattle, WA, 1999), pp. 276–282.
8. Whittaker, S. and Sidner, C. E-mail overload: Exploring personal information management of e-mail. In *Proceedings of the CHI '96 Conference on Human Factors in Computing Systems*, 1996, pp. 276–283. ☺

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