

Managing long term communications: Conversation and Contact Management

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Abstract

Contact management is an important part of everyday work. People exchange business cards to try to enter each other's contact lists. Local businesses provide refrigerator magnets and calendars so they will be called on when a particular need arises. People who use the telephone extensively are selective about who they add to their speed dial lists. Contact management and conversation management are linked. Many busy professionals discourage voice calls and messages, because email enables them to better manage their time, conversations, and contacts. People also spend large amounts of time transcribing voicemail, browsing email archives and writing todo lists – all of these activities are intended to help track the content and status of outstanding conversations. Together, these practices reveal some of the complexities of contact and conversation management.

We investigated contact and conversation management by carrying out twenty semi-structured interviews with professionals in assorted fields. Key properties of technologically-mediated conversations identified were: (1) they are extended in time, which means (2) people typically engage in multiple concurrent conversations, and (3) conversations often involve multiple participants. These properties led to a significant memory load for our informants: they spoke of the difficulty of keeping tracking of conversational content and status, as well as the identity, contact information, and expertise of their conversational partners. People respond to these problems by trying to make key aspects of their conversations persistent; however, with current support tools, this strategy meets with mixed success. Building on the findings of our study, we present a new support tool that aids in managing contacts and conversation status.

1. Introduction

Asynchronous interpersonal communication is ubiquitous: a recent report by the IDC Gartner Group [12] showed that over 4 billion corporate email messages are sent each day. There are 83 million voicemail users in the US alone. Asynchronous communication has become necessary for managing and executing many tasks [14,33,34,35]; 71% of respondents to the IDC survey said email was 'essential' for their everyday work.

Despite its ubiquity and importance, until recently, much theorising about asynchronous communication was derivative of face-to-face models of communication [24]. The emphasis of early asynchronous theories was on media differences between face-to-face and asynchronous communication. According to the media differences approach, face-to-face communication is multimodal, relying on speech, gaze and gesture, whereas most asynchronous technologies, e.g. email and voicemail, are unimodal. Media difference research argues that asynchronous communication differs from face-to-face communication in ways that follow directly from the absence of non-verbal information afforded by gaze and gesture, so that asynchronous conversations are more ambiguous [5], less socially inhibited [28], and show different grounding processes [4]. By emphasising media differences, such work tended to ignore other crucial aspects of asynchronous communication such as the fact that communications are permanent: that they extend across time [16,31], and that they are multi-threaded [9]. One aim of the current research is to uncover problems of contact and communication management that follow directly from these long-term, multi-threaded aspects of asynchronous communication.

Research on email [14,33], voicemail [34], and instant messaging [20,35] has revealed various features of asynchronous, technologically mediated interpersonal conversations. These conversations consist of multiple messages exchanged over a fairly extended period of time: days, weeks, or even months. This extension of conversations over time implies that people typically are engaged in many such conversations at any given time. And each conversation often involves multiple people. Furthermore conversations may occur across different media, so that emails and voicemails may be exchanged about the same topic, requiring integration of information across media. These properties lead to significant problems of conversation management. People also find it difficult to keep track of the content and status of their conversations, as well as the identity, contact information, and expertise of all their conversational partners. Maintaining knowledge of one's contacts is a significant problem in its own right: we refer to this problem as contact management.

In response to these problems, people try to extract key information from their conversational streams and make it persistent. For example, it is common to take written notes about a voicemail message before deleting it [34]. Contact management technologies – such as paper-based address books, speed dial lists, Personal Digital Assistant address listings, online directories, and assorted ad-hoc computerised strategies – are widespread. Again, often the goal of these technologies is to help extract important information from the ongoing conversation (such as contacts' addressing information) for future use. Note that contact management functionality is increasingly being integrated into communication tools, e.g., email address books, email aliases, telephone speed dial lists, and buddy lists all embed address information into communication technologies. Thus, it will be productive to study the conversation and contact management tasks in a unified way. Knowledge gained from such studies will inform the design of better support tools, and broaden our theorising about asynchronous communication.

We carried out such a study, carrying out twenty semi-structured interviews with professionals in diverse fields. The interviews illustrate the difficulties of conversation and contact management and reveal the strategies and artefacts our informants used to cope. We identify a number of shortcomings with current artefacts and strategies. Finally, we describe a novel software tool we developed to support contact management and limited aspects of conversation management.

2. Method

Our research perspective is artefact-centred cognition [11,22]. We proceed from the view that cognition is a process that often involves interaction between humans and external tools or representations. We have argued that asynchronous communication presents people with memory problems. Thus, the artefact-centred perspective leads us to ask what external tools and practices people use to address these problems.

We investigated these questions by carrying out a series of semi-structured in depth interviews. We asked people about their communication practices, including contact management strategies. We concentrated on uncovering the tools people used, specific ways the tools were used, and the problems they experienced. We often asked subjects to demonstrate usage practices. The interviews focussed on (a) the problems that users experienced with contact and communication management; (b) the tools and strategies that they adopted to address those problems; (c) the utility of those tools and strategies. Typical questions asked were: 'How do you remember whether you've replied to a phone call, or not?' 'What tools or strategies do you use to help you remember?' 'How successful are these tools and

strategies?' 'When do they succeed and when do they fail?' Although the overall set of topics covered was the same for all informants, the sequence of topics varied according to the informant's responses (for example if a participant begins to provide information relevant to a later topic, the interviewer would switch to that topic). The interviewer was at liberty to ask impromptu follow up questions, for example, when the informant's reply was ambiguous.

We interviewed a total of twenty people. All participants had extensive experience with asynchronous communications media such as email voicemail, and fax. They also all used some contact management tool, such as an address book, PDA or daytimer. Most participants were professionals, including financial analysts, lawyers, brokers, estate agents, bankers, IT managers, academics, researchers, secretaries, administrators, marketing managers, conference organisers. They worked in a variety of settings from multinational corporations to personally owned small businesses; all were located in the greater New York metropolitan area. Participants were selected for diversity of daily work activities and settings.

Seventeen of the interviews took place in the subjects' work place, two at their homes, and a travelling broker was interviewed in the office of one of his clients. The interview setting clearly influenced subjects' responses, with home interviews focusing more on personal contacts. The average interview lasted 75 minutes, with times ranging from 45 to 150 minutes. Eighteen of the interviews were audiotaped and transcribed. One subject declined to be recorded for legal reasons, and the recording quality of one audiotape was too poor to be transcribed; thus, the points extracted for these two participants are based on interview notes. In total, the data consisted of over 28 hours of recordings, which, when transcribed, resulted in 737 pages (about 219000 words) of text, along with extensive handwritten interview notes.

We analysed the data by identifying for each informant (a) the tools and strategies used for communication and contact management; (b) the problems that they experienced with those tools and strategies. We present representative quotes to illustrate these, while noting important differences in the experience and perspectives of different participants. All names have been changed to preserve participants' anonymity.

3. Results

To review, the general problems our informants described were: 1) remembering the content of conversations, 2) tracking status and outstanding actions; 3) maintaining contact information. We will structure the discussion of our findings around these three problems.

3.1 Memory For Conversational Content

Our participants pointed out the problems of remembering what had been said in complex long-term communications. This problem was exacerbated when large numbers of people were involved in the project, or when multiple communication modes were involved (e.g. email, voicemail, Fax, documents). Simon a corporate lawyer commented: *“Case tracking is a real problem for us. You have to remember who was talked to, about what, and when. That’s really important when you’re dealing with legal information. And we have a [software] system with that information so that I find a case and look up who talked to who when.”* Remembering what has been said is important for a variety of reasons. Participants often have to remember specific facts, names, numbers, or the details of decisions that are part of prior conversations. They may have to make decisions based on prior conversations, or they may have to respond to questions others have put to them about material discussed in those conversations.

Participants used a variety of different tools for recording the content of conversations: call slips (special notes designed for the purpose of recording voicemail messages), voicemail logs (notebooks used for the sole purpose of recording information about the date, time and content of messages). They also used email and voicemail records, and external representations such as spreadsheets and documents.

Participants employed a number of different strategies involving these tools to remember conversational content. The most straightforward strategy was to browse email or voicemail records. A number of users, however, found it problematic to access information from voicemail data and developed strategies to deal with this. One frequent strategy was to convert voicemail records to text using call slips or phone logs, in order to make information more accessible. (This strategy is extensively documented elsewhere - see [34]). Eddie an investment analyst noted: *“If they’ve left me a message, I’ll always record it. ... any legitimate message gets recorded. Then I just make the decision--like I did with that guy B.--whether I’m actually going to return the call or not, or when I’m going to return [it]”*. Another variant of this strategy was to coerce others into using textual (as opposed to auditory media) to avoid having to access voicemail information. The following is the greeting message from Maurice, a university professor’s voicemail: *“For the latest information on graduate information systems go to my web site xxx. You can also obtain my email address there if you wish to contact me. If you wish to know my office hours contact the secretaries on xxx. If you wish to have stuff mailed to you contact the secretaries as well. Thank you.”* This greeting message could also be seen as a form of stream management, where the aim is to

reduce the complexity of conversation management by trying to force communication into fewer channels.

There were a number of problems with these strategies. One obvious one for voicemail messages is the sheer effort of recording the relevant information, in call slips or logs. There were also problems when communication involved multiple participants. Although our informants sometimes created specialised external representations, to allow group data sharing, these were often inconsistently updated. Simon again: *“But the problem is that we in legal aren’t consistent. We don’t agree what’s important and we all record different types of facts. In someone got knocked down by a truck tomorrow, could we reconstruct this case? Some of it, yes, but not all the important details. Again it’s a management issue. If you start saying to people they should keep better records of conversations then they say ‘well hang on. We’ve enough to do getting the cases done, without recording all this extra information’.”*

3.2. Status Tracking And Remembering Outstanding Actions

Another problem was remembering the status of communications, and in particular whether there was some outstanding action required, such as the need to follow up on a prior communication. Eddie commented: *“So, from a contact standpoint, what is my biggest problem and my biggest nightmare? My biggest problem is the possibility that I’m forgetting to return a call on a timely basis or forgetting to respond to an e-mail on a timely basis. ... And with this [phone log] as I say, my biggest nightmare is that there’s a call in here in the last week that I haven’t returned, and I’ve forgotten I haven’t returned it.”*

Tools for status tracking included: paper todo lists, stickies, hands, whiteboards, calendars, as well as the use of conversational records as implicit reminders. One common strategy users described was ‘one touch’ where the goal is to avoid the problem of status tracking altogether by attempting to respond to each incoming message immediately, leaving no outstanding action. However there are a number of reasons why one touch cannot always be enacted: participants may not have the time to respond immediately, or they may lack necessary information, making message deferral a necessity. Most informants also described explicit reminding strategies where they placed reminders about outstanding communicative actions in strategic locations, where it would definitely be seen. George, an R and D manager noted: *“If I know I’ve forgotten to return a phone call, the only thing I can’t lose is my hand. I can wash it, but at least I have a several hour interval of time when it will be available-- So I write phone numbers on my hand, okay. And that’s usually the return calls I’ve been forgetting for awhile.”* Other people placed

reminders in their calendars so they would be seen and acted upon at the relevant time. Katie an estate agent described this: *"I take the call slips with me and then I staple them into my [calendar] here. If I'm disorganized then I'll just stuff them in there. Having them in my [calendar] reminds me that I need to call them back."* Another set of strategies used the conversational record for implicit reminding [33,34]. The presence of previously read messages in the email or voicemail inbox was often used as to indicate that those messages needed some action. Karl, a business development manager in a large telecommunications company explained this: *"This is my Inbox... This one says I replied to it; it's on its way; and I still need to do some work on it. So it's there as a reminder. Should he call me, I can go back and refresh my memory.. So these are things that are just kind of tickler file, remembering things. The ones that are darkened that are marked as still new are ones I still need to do something."* Like Karl, many people also reported manipulating the unread status indicators in email, by resetting messages to 'unread' status to increase their salience.

There were a number of reported problems with these status-tracking strategies. Explicit reminders are problematic because they require some effort to set up, and reminders may get lost, or never acted upon. Interestingly a number of our informants reported that online systems were generally bad for explicit reminding – alerts seemed to go off at the wrong times, reminders did not seem to be salient, and they could not be placed at various physical locations to cue action. Implicit reminders were problematic because they often lost salience in the conversational record [3,33]. Several users reported that the presence of too many items in the email/voicemail inbox meant that outstanding items 'disappeared'. Mary, a freelance researcher pointed this out: *"There are some times when things go off the top [of the inbox] that I put here as a reminder. And I don't get to them because I forgot"*. Eddie made the same point about how email overload undermines this system of using the inbox as a 'todo' list: *"With an e-mail, I kind of almost wish I had a separate category for "pending", except it would probably get filled up too quickly, and I'd never clean it out. So I basically use my Inbox as a "pending" box, which is inefficient. So I wish I had some way to separately classify "pending"--things I'm supposed to respond to but haven't, yet."*

One general problem for conversation tracking lay in determining who was contributing to a given conversation. When accessing the conversational record in order to summarise group communications, informants were often unclear exactly whose messages they should be accessing. Part of the problem is that the personnel contributing to different work teams are often amorphous with different people participating at different points. Project membership can be fluid with people leaving and joining projects or

contributing expertise on an opportunistic basis. One consequence is that people often don't know who to send project updates to. Eddie again talked about this: *"Yesterday, I got an e-mail from one of the lawyers discussing a point about some of the regulatory environment that we're in. And he sent it a bunch of people who, so far as I could see, had no interest at all--or should have no interest--in the point that he was raising. So, when I replied, I just edited them out. So as not to waste their time ... here's that e-mail that the guy sent me --he cc'd it to half a dozen people. Three of them aren't going to give a crap."* The amorphousness of project personnel leads to two opposing problems: 'overcopying' and 'undercopying'. An overcopying strategy sends information to any person who might possibly have an interest in the message, reducing the likelihood that relevant people will be overlooked. The disadvantage of overcopying, however, is that it leads to proliferation of email as our informant notes. Undercopying has the opposite effects: fewer people get the information, reducing potential 'spam', but relevant people are more likely to be missed.

3.3. Contact Management

There are two critical aspects to contact management. The first is *tracking complex information* about contacts' addresses and whereabouts. The second is maintaining relationships by *keeping in touch*.

Our informants were all aware of the need to retain long-term information about important people. All constructed complex systems for the purpose of managing information about people. Mary had a thousand people in her email address book, a 60 page Word document containing 1200 people, 400 people in her PDA, as well as miscellaneous people in Christmas card lists. Ollie a researcher had 7 different address books, including 2 PDAs, Outlook, and 4 independent email address books. He also wrote key work numbers on his office blackboard. Participants were also lucid about the benefits of such information. Mary made this point forcibly: *"I cannot work today unless I have some source of contact information, some organized source so I can actually actively search for people. I use this list all the time just to browse it to find people when I need somebody to do a particular task."* The importance of personal contacts for labour recruitment, and information access has been well documented elsewhere [1,8,29,32]. Nevertheless the strategies that people use to create and maintain usable sets of personal contacts has been much less well documented [15,20].

Our informants used a plethora of different tools for contact management including: dedicated tools, such as personal address books (both digital and physical), corporate address books and organisation charts; device specific addressing using email address books, speed dials

on their phones; other generated information such as fridge magnets or business cards (sometimes stored in rolodexes); hotlists - small sets of important frequently called numbers usually placed in salient locations; ephemeral contact information on sticky notes or on calendars; indirect search - extracting contact information by searching through email or phone records; social search - asking other people who might know.

There were however a number of general problems with these tools. Entering contact data is tedious, which is exacerbated by the fact that data entry has to be accurate: an inaccurately recorded phone number or email address is useless. In addition, our participants communicated with vast numbers of other people, so participants need clear criteria for deciding whom to register contact information about. Our informants suggested two such criteria. The first criterion was: reciprocity and the expectation of future interaction. Simon puts it this way: *"The people who end up in my Outlook are people who I think that I'll have some to contact at some future time. Some of them I have longstanding relationships with, but most of them I don't. I just have to call them back. Now if they call me, and there's no reason for me to call them back, then I don't waste my time putting them into Outlook. So if people are trying to sell me a service that I don't want or they are trying to form a relationship with MegaTel that the company doesn't need, then they don't get in there. Of course the problem is that a lot of the time its hard to tell at the outset in some cases, so I tend to be a bit conservative about putting people in."*

A second criterion signalling contact utility was communication frequency. Eddie commented: *"Important people to me are people that I talk with a lot. And people I've talked with a lot in the last week or month, then they are really important to me."* Most informants also constructed hotlists of frequently used addresses or numbers - often paper lists -- which they placed at strategic physical locations by a phone or computer. Participants were also well aware that they were not always accurate in their assessments of who might be a future valued contact, and most kept detailed conversational records of prior email or voicemail and frequently searched through these records for contact information that was missing from their address books, speed dials or hotlists.

People also talked about the importance of *tailored communications* and the need to represent contacts' communication preferences. They wanted to choose media carefully, to respect the communication preferences of their contacts and to fit the demands of the task. The importance and complexity of appropriate media choice has been extensively documented elsewhere [5,17].

Our informants also experienced several problems with deciding how to represent contact information. One difficulty arises because they needed to access by expertise as well as name. Over periods of months, or years, informants often forget contact information. They might remember that they had contact with experts in a particular area, but be unable to remember their names. Simon talked about how he stored information in Outlook by expertise rather than by name to avoid this problem: *"So what I do is to enter their name, information about their function, expertise and sometimes the dealings that I've had with them. So Export-Licensing-Ron-Noades isn't a person. Ron is a person but I'd never remember his name, but I would remember that I had dealings with someone who knew everything you ever wanted to know about Export-Licensing, so that's what I search on in my Outlook"*. Some informants also had to store extremely detailed information about contacts. For people in sales professions, extensive factual information about a contact is often necessary. Karl commented: *"As a salesperson, it's very important to know who your contact is, who are the people important in their lives, what their likes and dislikes are, what they like to eat, what they like to drink, what they--how much you sold them the last time and what their current interests are. All that's got to be in there"*. In order to facilitate retrieval several informants described the need for structured contact data - to respect the different types of task that they carried out. David an accountant in a large multinational bank described the different email lists he used for different tasks: *"The [list] you're looking at now is a list of people who I have to go out to once a month for information, fairly specific financial information on what they've spent and things like that. I've got other lists of different levels of managers that I need to go to for different purposes. I've got a power list of the four or five really top people in my world, who, sometimes, I need to send an announcement to them or ask them all a question. Then I've got broader ones of slightly lower-level people who I will go to for different sorts of information or who need to know different levels of things."*

Despite the desire for structure, participants often found it difficult to organise their contacts. One obstacle to organising contacts was the amorphousness of project teams. We have already described how different people contribute at different phases of a project. This amorphousness sometimes makes it difficult to systematically organise people according to work-related tasks or projects. Organisation is critical for *associative reminding*. Informants often talked about how accessing information about one contact would trigger memory for a forgotten contact. If contact information is well structured then this can greatly facilitate associative reminding.

Another key issue with contact management was where information was to be stored. A few participants relied on a

single place to store most of their contact information, such as an address book, PDA or program such as Outlook. Some employees of large companies relied heavily on corporate directories that provided general contact information about employees. Others distributed information among different devices, storing email addresses in their email system, or phone numbers in their speed dial lists. Yet others placed relevant information around their environment in the form of fridge magnets, sticky notes or hotlists. A number of factors affected informants' strategies here. One factor was mobility and whether participants needed access to information while they were on the road: Simon again: *"I take my laptop everywhere in the world, wherever I go. If I go to [X], to work at [Y] I take it, I even take it if I'm going to Cancun on vacation, because it's vital that I keep in touch with people and have the means to get back to them when I need to. That's why I need the contact information on the laptop."* Another major determinant of the amount and type of contact data stored was the ease with which it could be acquired. Most email systems and mobile phones make it possible to acquire addresses or numbers with a single user action. Ease of data entry meant that users often had large repositories of device-specific information. Indeed Mary had added so much contact information into her email address book that she was unable to state whether specific contacts were in it or not!

Contact management also had a strong social component. People often exploited others to elicit recommendations from others about useful contacts. Mary talks about moving to a new area, where at her housewarming party she asked people to make recommendations about local service people or professionals whom she could add to her address book. However, once it became known what Mary had done, she was treated as a local expert for this information, so that people now contact her to find recommendations: *"We had a housewarming party where we sent out an invitation and gave everybody three by five cards, and they had to come back with a recommendation. Because we moved into the new neighbourhood and we didn't know plumbers or dentists or doctors or anything... All the recommendations are in here. And people know that we have this list now, and so they call us up and ask us to recommend an X. And so we're becoming a sort of Ivytown local knowledge group because we did this at our housewarming."* Participants also had clear ideas about who would have access to important contact information they couldn't remember [1,15,29]. In other settings, participants also shared sets of contacts, and a number of participants (4 of the 20) inherited their predecessor's Rolodex.

But contact management isn't restricted to recording addressing information about other people. Contact management also includes activities that are intended to

prime and preserve the relationship between informant and contact [18]. Informants frequently talked about the need to *keep in touch*. Katie, explained: *"A friend of mine sends Christmas cards and small presents to all her clients. That's always been my intention, it helps people to remember you which is important in our business. But I'm just never organized enough. One year I did the cards but I've never managed the presents. And the way that I justify it to myself is that sending presents to people seems like manipulation, and I don't want to appear to be doing that"*. It is important to note that the activity of keeping in touch often did not seem to serve an instrumental purpose: informants often simply wanted to remind others of their existence.

Informants used a number of different strategies to remind themselves about others they needed to keep in touch with. They often sent out social greetings when there were significant events such as Christmas or the contact's birthday. Others sent out messages at more regular intervals for this purpose. Another set of techniques involved reminding, so that informants might put photographs of friends or family on the fridge or family bulletin board partially as a reminder to call. One informant described the Dutch tradition of hanging a calendar containing significant birthdays in a salient place such as the bathroom where it can serve as a frequently seen reminder of significant events in those contacts' lives.

4. ContactMap System

The results of the semi-structured interviews highlight many of the limitations in current tools for the linked activities of contact and conversation management. Today such tools typically visualise or abstract communication in terms of messages, subjects, and folders. Contacts themselves are represented in terms of a list-based address book. Our interviews suggested, however, that people often construe interactions in terms of networks of people with whom they interact. Our hypothesis was that software that explicitly represents the user's personal social network of contacts in a *social desktop* can provide better support for the three main problems our subjects identified: 1) remembering the content of conversations, 2) tracking status and outstanding actions; 3) maintaining contact information

We now describe ContactMap, a visual interface that aims to provide a new type of visual model, a social desktop, for organising ongoing conversations and social relationships, by explicitly representing the user's personal social network. ContactMap has two important characteristics: (a) it provides support for contact management tasks by representing the user's social network directly; (b) it presents a people-centric rather than a message-centric organization of communication to address problems observed with communication management. Our description of ContactMap focusses on how it addresses the

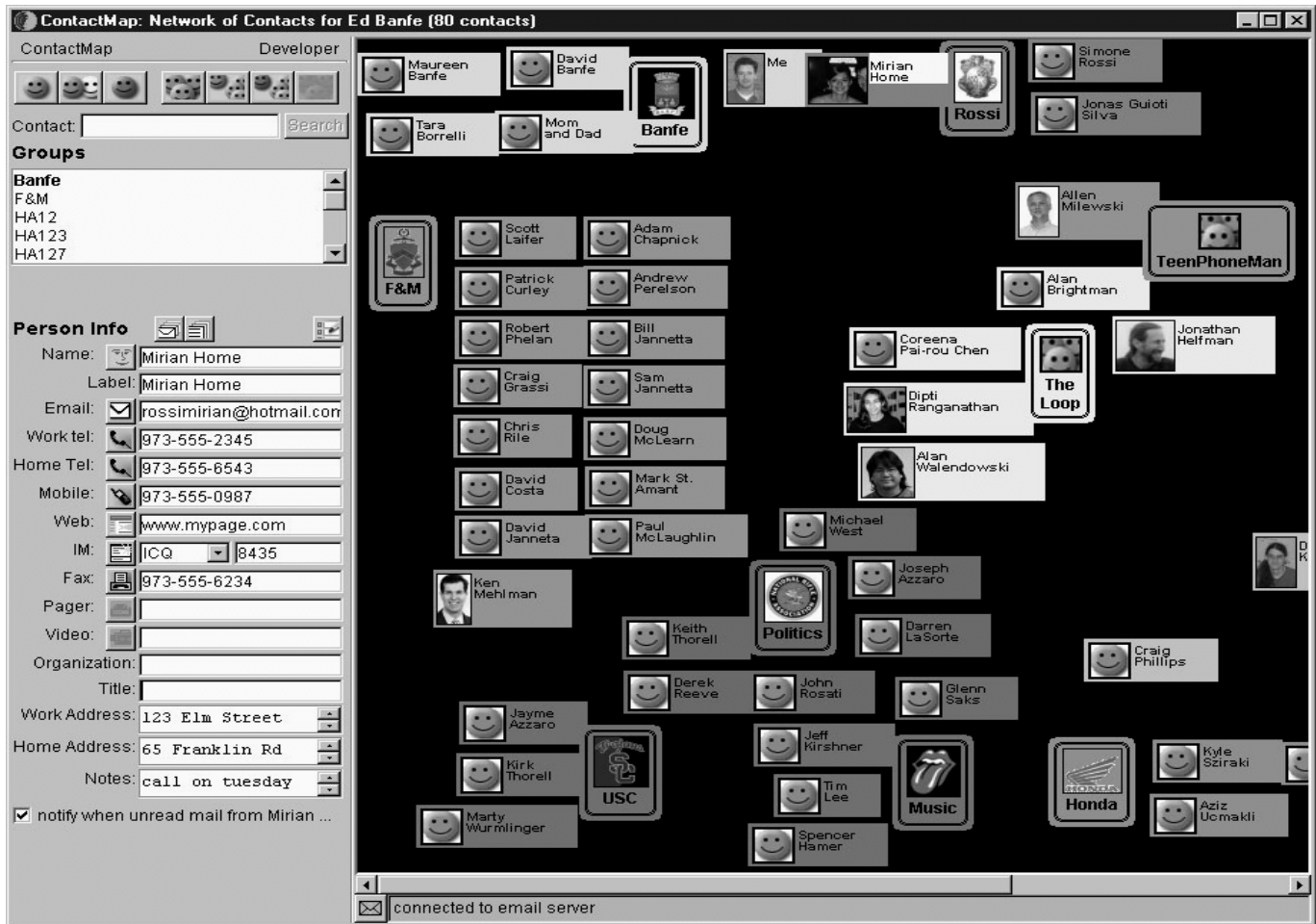


Figure 1 - ContactMap User Interface

4 contact management and communication management tasks of tracking contact information, keeping in touch, status tracking, and remembering communication content. We also describe how ContactMap assists users in the extraction of their networks from email, reducing the tedium of data entry.

ContactMap (see Figure 1) allows users to arrange their social network in a visual map of individual contacts (e.g. Miriam Home, Maureen Banfe) and groups (e.g. Music, TheLoop). Each node (contact or group) affords a variety of communication and information retrieval functions. ContactMap is written in Java 1.3.1, using Swing for the user interface and Sun's JavaMail API for searching IMAP (Internet Message Access Protocol) email.

The system models the user's personal social network, showing people who are literally central or peripheral to the user's work and personal life. Users arrange contacts (represented by a label and picture) to reflect their relationships to each other and to the user. This enables users to see, at a glance, who is in their network and perceive relationships between network members.

Contacts may also be assigned to one or more groups, with all the icons for a given group (e.g. TheLoop) being a common color. Groups may also be given a specific visual logo (see, Honda and Music). The groups themselves are arranged spatially to reflect their relationships to one another. Groups typically constitute social categories such as friends (F & M), family (Banfe, Rossi), work projects (TheLoop, TeenPhoneMan), hobbies (Politics, Music) or organizational affiliations (Honda, USC).

Users select a contact with the mouse; the left panel of the display shows information for the selected contact (Miriam Home) such as group affiliations and information such as email address, phone numbers, web page, fax, pager and so on. The icons in the panel (Work Tel, Email) activate functions such as initiating a click-to-dial phone call, addressing an email message, showing that contact's web page, and accessing emails exchanged with that person.

One vital aspect of *keeping in touch* is being reminded about the existence of people in one's social network. ContactMap makes all contacts highly visible, so that even less frequently accessed contacts may be seen and hence

remembered in the course of executing other activities. The network structure also serves to promote associative reminding. Related contacts are stored close to one another, so that accessing one contact may visually remind the user about a related contact. The map view and contact panel also support *tracking contact information*. The map shows contact identity and relations between contacts, and the panel contains contact address information.

The social network map also facilitates access to prior conversations, and hence *memory for communication content*. Each contact node provides access to information exchanged between the user and the contact, such as email messages. This makes it straightforward to access messages and documents associated with various individuals or groups of contacts. Accessing group messages is especially easy when a project is represented by a user-defined group. However, ContactMap also supports accessing communications among ad hoc sets of people: e.g., users can select sets of contacts from anywhere on the map and access the communications they exchanged.

Users can also place reminder notes on a contact (signalled by red dots), to indicate some outstanding action in relation to that contact. Rolling over the contact displays the relevant note. ContactMap also provides alerting information about contacts, e.g., that they have sent new email. Together these features support *conversational status tracking*.

ContactMap contains a great deal of information about personal contacts that is often stored in personal information management tools and address books. In our interviews, a frequently reported problem with these tools and was that they require extensive amounts of set-up and data entry. In order to “bootstrap” the creation of an individual’s ContactMap, we take advantage of the fact that personal social networks emerge from repeated interactions. We therefore extract personal networks by analyzing the *history* of a user’s email interactions (in future versions we will also analyze other media such as voicemail and phone logs to extract networks).

We have also conducted an empirical comparison of ContactMap and traditional email systems, in which users performed tasks motivated by our fieldwork. Users performed better with ContactMap than their usual email system, and they strongly preferred ContactMap for these tasks. Analysis suggests that ContactMap’s visual network interface supports scanning and associative reminding, allowing users to identify relevant contacts and messages more quickly. User feedback also highlighted a number of weaknesses in our system that we are currently addressing: (a) large numbers of contacts are difficult to

represent on screen and we need to provide mechanisms for “hiding” contacts; (b) we need to extend the current communication management and contact seeding process to include telephone or voicemail logs [10,34]. Automatically extracting information from existing online address books would also be useful; (c) people pointed out that much of their networking is done while they are away from their computers in mobile settings. We hope to explore future versions of ContactMap operating on small devices. This raises significant visualization challenges, for presenting complex visual information on a very small display.

5. Conclusions and Related Work

In conclusion, we have presented empirical data supporting the need to broaden our theoretical view of asynchronous communication. Once we consider conversations taking place across multiple media over periods of weeks, months and years then a new series of problems emerge. By examining the use of various artefacts to support memory for long-term communication, we have unearthed new problems for theory. Our theories of communication need to address problems of conversation management in the form of memory for content, status tracking, and participant tracking. Those theories also need to account for contact management: how do users construct structured representations containing address, expertise, and personal facts for the important subset of people they communicate with? And how do users manage relationships and keep in touch? Finally we have described a system ContactMap that attempts to address some of these problems. We are currently evaluating the utility of ContactMap for a variety of communication and contact management tasks.

How does this work relate to other recent research on asynchronous communication? A number of recent tools support visualisation of asynchronous communications, which is relevant to tracking of conversational content and status. Thus the Conversational Landscape [30], and Fugue systems [25] present views of conversational threads over time, as does the work of Smith and Fiore [27] provides a structured view of unfolding conversations based on content analysis. Erickson and Laff [7] designed the Babble timeline to create awareness of synchronous and asynchronous communications over time. Neuwirth et al., [21] provide views of email classified by task, which is at the heart of the conversational status tracking we describe here. Our findings on contact management document the importance of assessing contacts by expertise. Recent research on recommender systems also describes techniques for identifying domain experts

[15,23,29]. One critical difference between recommender systems and what we describe here, is that contact management involves the abstraction and representation of expertise from personal communication records whereas recommender systems have tended to focus on public data sources (e.g. the internet).

This work also ties into recent research addressing outeraction, namely the set of processes that are necessary for interaction to take place [19,20]. Elsewhere we have documented the work that people put into maintaining social relationships in order to promote long term interaction [18,19,20]. The current study documents the work of remembering conversational content and status that is necessary for successful asynchronous interactions. We also point out the need for contact management: without systematic attempts to record structured information about contacts' addresses and expertise long-term communication would be impossible. Conversation and contact management therefore constitute central elements of outeraction. Finally, our data also highlight a paradox about asynchronous communication: despite the fact that conversations are by definition permanent, they nevertheless impose considerable memory burdens on participants to extract, record and manage important elements of the ongoing communication stream.

6. References

- [1] Allen, T. J. (1977) *Managing the flow of technology*. Cambridge, MA, MIT Press.
- [2] Amento, B., Hill, W., Terveen, L., Hix, D., and Ju, P. (1999) An Empirical Evaluation of User Interfaces for Topic Management of Web Sites, In *Proceedings of Conference on Human Factors in Computing Systems*, 552-559, ACM.
- [3] Bälter, O. (1997). Strategies for organising e-mail. In Thimbleby, H., O'Conaill B., and Thomas P. (Eds.), *Proceedings of Human Computer Interaction 1997*, 21-38, Springer, London, UK, August 1997.
- [4] Clark H. & Brennan, S. (1991). Grounding in communication. In L.B. Resnick, J. Levine & S. Teasley, Eds. *Perspectives on socially shared cognition*. Washington DC., APA Press.
- [5] Daft, R. and Lengel, R. (1984). Information richness: a new approach to managerial behavior and organizational design. In B. Straw and L. Cummings, (Eds). *Research in Organizational Behaviour*, Greenwich, CT., JAI Press.
- [6] Erickson, T. (1999). Making Sense of Computer-Mediated Communication (CMC): Conversations as Genres, CMC Systems as Genre Ecologies. In *Proceedings of the Thirty Second Annual Hawaii International Conference on Systems Sciences*, IEEE Press.
- [7] Erickson, T. and M. R. Laff (2001). The Design of the 'Babble' Timeline: A social Proxy for Visualizing Group Activity Over Time. In *Proceedings of Conference on Human Factors in Computing Systems*, Seattle, ACM.
- [8] Granovetter, M. (1973) The Strength of Weak Ties. *American Journal of Sociology* 78, 6, 1360-1380.
- [9] Herring, S. C. (1999). Interactional coherence in CMC. *Journal of Computer Mediated Communication* 4(4).
- [10] Hirschberg, J., Bacchiani, M., Hindle, D., Isenhour, P., Rosenberg, A., Stark, L., Stead, L., Zamchick, G., and Whittaker, S. (2001). SCANMail: Browsing and Searching Speech Data by Content, *Proceedings of Eurospeech 2001*, Aalborg.
- [11] Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA.: MIT Press.
- [12] IDC Gartner Group. (2000). *Email usage forecast and analysis, 2000-2005 study*.
- [13] Kiesler, S., J. Siegel, et al. (1984). "Social psychological aspects of computer-mediated communication." *American Psychologist* 39(10): 1123-1134.
- [14] Mackay, W.E. (1988). More than Just a Communication System: Diversity in the Use of Electronic Mail. In *Proceedings of Conference on Computer-Supported Cooperative Work*, ACM.
- [15] McDonald, D. and Ackerman, M. (1998) Just talk to me: a field study of expertise location. In *Proceedings of Conference on Computer Supported Cooperative Work*, 315-324. New York, ACM Press.
- [16] McGrath, J. (1984). *Groups: Interaction and Performance*, New Jersey: Prentice-Hall.
- [17] Markus, M. L. (1994). Electronic mail as the medium of managerial choice. *Organization Science*, Vol. 5, No. 4, 502-527.
- [18] Nardi, B., Whittaker, S., Schwarz, H. (2000) A Networker's Work is Never Done: Joint Work in Intensional Networks. To appear in *Journal of Computer-Supported Cooperative Work*.
- [19] Nardi, B., Whittaker, S., Bradner, E. (2000). Interaction and Outeraction: Instant Messaging in Action. In *Proceedings of Conference on Computer Supported Cooperative Work*, 79-88.
- [20] Nardi, B and Whittaker, S. (2001). The place of face-to-face interaction in distributed work. To appear in P. Hinds and S. Kiesler (eds), *Distributed work. New ways of working across distance using technology*. MIT Press.
- [21] Neuwirth, C.M., Morris, J. H., Regli, S. H., Chandhok, R., Wenger, G.C. (1998) Envisioning communication: task-tailorable representations of communication in asynchronous work. In *Proceedings of Conference on Computer Supported Cooperative Work*, ACM.
- [22] Norman, D. (1988). *The Psychology of Everyday Things*. New York, Basic Books.

- [23] Resnick, P and Varian, H. (1997). Recommender systems. *Communications of the ACM*, 40(3):56-58, March 1997
- [24] Rice, R. E. (1988). Issues and concepts in research on computer-mediated communication systems. *Communication Yearbook*. J. A. Anderson, Sage. 12: 436-476.
- [25] Rosenberger Shankar, T., M. VanKleek, et al. (2000). Fugue: A Computer Mediated Conversational System that Supports Turn Negotiation. In *33rd Hawaii International Conference on System Sciences*, Maui Hawaii, IEEE.
- [26] Sack, W. (2000). Discourse Diagrams: Interface Design for Very Large-Scale Conversations. *Hawaii International Conference on System Sciences*, Maui Hawaii, IEEE Computer Society.
- [27] Smith, M. A. and A. T. Fiore (2001). Visualization components for persistent conversations. In *Conference on Human Factors in Computing Systems*, ACM.
- [28] Sproull, L. and Kiesler, S. (1986). Reducing social context cues: electronic mail in organizational communication. *Management Science*, 32, 1492-1512.
- [29] Terveen, L.G and Hill, W. (2001) Human-Computer Collaboration in Recommender Systems, in Carroll, J. (ed.), *HCI in the New Millennium*, Addison Wesley.
- [30] Viegas, F. B. and J. S. Donath (1999). Chat circles. In *Proceedings of Conference on Human Factors in Computing Systems*, 9-16, ACM.
- [31] Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research* 23(1): 3-43.
- [32] Wellman, B. (2001) Physical Place and Cyber Place: The Rise of Networked Individualism. *International Journal of Urban and Regional Research* 25(2), 227-52.
- [33] Whittaker, S. and Sidner, C. (1996). Email overload: exploring personal information management of email. In *Proceedings of Conference on Human Factors in Computing Systems*, 276-283, ACM.
- [34] Whittaker, S., Davis, R., Hirschberg, J., & Muller, U. (2000). Jotmail: a voicemail interface that enables you to see what was said. In *Proceedings of Conference on Human Factors in Computing Systems*, 89-96, ACM.
- [35] Whittaker, S., Swanson, G., Kucan, J., & Sidner C. (1997). Telenotes: managing lightweight interactions in the desktop. *Transactions on Computer Human Interaction*, 4, 137-168.