Analysing Meeting Records: An Ethnographic Study and Technological Implications

Steve Whittaker, Rachel Laban and Simon Tucker

Department of Information Studies, University of Sheffield,
Regent Court, 211 Portobello Street, Sheffield, S1 4DP, UK
{s.whittaker, lip03ral, s.tucker}@shef.ac.uk

Abstract. Whilst there has been substantial research into the support of meetings, there has been relatively little study of how meeting participants currently make records and how these records are used to direct collective and individual actions outside the meeting. This paper empirically investigates current meeting recording practices in order to both understand fundamental collaboration processes and to determine how these might be better supported by technology. Our main findings were that participants create two types of meeting record. Public records are a collectively negotiated contract of decisions and commitments. Personal records, in contrast, are a highly personalised reminding tool, recording both actions and the context surrounding these actions. These observations are then used to informally evaluate current meeting support technology and to suggest new directions for research.

1 Introduction

Despite their importance and prevalence there is a general perception that meetings are not as efficient as they might be. Self-estimates of meeting productivity for many different types of managers range from 33-47% [1]. Early psychological studies of meeting processes identified problems such as process loss and free riding - documenting how individual efforts are dissipated by collective group processes. However, another inefficiency is information loss, i.e. the failure to record important information, decisions and actions and how this affects future actions. Here, we are interested in information capture and use: how people record different types of meeting information and how this affects future individual and collaborative work. Further to this we are interested in how well current technology addresses these needs and what is required to enhance the technological support available to meetings.

Studies of meeting practices examined information capture, documenting the importance of recording semi-structured information such as dates, announcements, phone numbers and names. They have observed a conflict for participants between taking adequate notes and contributing to meetings [2,3,14]. However with some exceptions [2] these studies did not investigate how the captured information was used to direct future individual and collective activities. The same work also explored technologies for capturing discussions. Many of these techniques were invented over 10 years ago, but despite their promise, there is still little sign of their being used in meetings. And despite the interest in yet more powerful capture tools [5,6], the predominant 'technologies' used today are pen, paper and whiteboards, and nontraditional technologies such as laptops tend to be used only for private note-taking.

Our study therefore addresses this paradox. We revisit the issue of capture, looking at current recording practices and exploring how they support collective action. We carried out an ethnographic study of two organisations investigating both individual and group practices for recording and representing meeting information. We investigate both the types of records groups and individuals make and what the benefits and problems associated with these records are. We then use these observations to critique current meeting access technology.

2 Participants and Study Context

The setting for our fieldwork was two UK service firms, one responsible for national and international mail deliveries and the other for supplying software services. In each firm we studied a core team through a sequence of multiple meetings. We chose to follow two teams in repeated interactions, rather than a large set of individual meetings, as an important issue concerned how information in earlier meetings was invoked and followed up on in later meetings.

The core teams had 5 and 7 members, and the target meetings had between 3 and 16 participants. This discrepancy arose because not all team members were able to attend all team meetings, and in the software company some meetings included customers from outside the organisation. In the delivery company the meetings were held on a weekly basis and their main objective was reporting and team co-ordination, as the team worked through issues arising during the previous week. In the software services company, meetings were between customers and suppliers. The main objective was to iron out difficulties associated with supply and delivery of services. Both sets of meetings were task-oriented rather than being about idea generation and they tended to be structured around written agendas. In both cases participants were familiar with each other, having worked together for over 6 months.

We collected many different types of data, including observations of participants' behaviour during meetings - when they took notes, when they talked and what they noted down. We carried out interviews with participants before and after meetings, and we analysed private notes and public minutes of the meetings. Overall we observed 7 separate one-hour meetings, generating 12 hours of observation, along with 25 hours of interviews over the course of a three-month period. We also made audio recordings of a subset of 3 meetings and then transcribed these recordings. Our principal observer had previously worked at the delivery company and had also dealt with the software company and was therefore familiar with both companies, allowing her to gain access to employees.

One issue that required careful negotiation was confidentiality. At the outset, we asked all participants whether they were comfortable being observed and recorded. All transcripts were anonymized by removing all identifying information such as participant, supplier and dealer names. All participants were informed that they could stop recordings being made at any point. They were also given copies of the meeting transcripts and asked whether they wanted information to be excised from the transcript and the original record.

We begin by describing the nature and functions of public records of meetings such as minutes. We identify the limitations of minutes, and how participants respond to these problems by taking their own notes in meetings. Next we describe the nature and functions of personal notes, as well as the problems users experience with these.

3 Results

3.1 The Nature and Function of Public Meeting Records

Our participant observations, analysis of minutes and interviews revealed that public records such as minutes had four main functions:

- To track group progress.
- To serve as a public record of past actions and decisions.
- To remind people about their commitments.
- To resolve disputes about commitments.

Minutes are an abstract record of attendees, group decisions, past actions and future commitments. They also document whether previous commitments and actions by group members have been carried out. On some occasions, they might include background information relating to a decision or action, but this tends to be the exception rather than the rule. Minutes are also general: they document all major decisions and actions, rather than focusing on specific aspects of the meeting.

Minutes were used in a variety of ways. People firstly used them as a public record against which to track group progress in order to determine whether recent actions or commitments had been carried out. Meetings often began with a run through the previous meeting's minutes. Participants would quickly review the main items minuted from prior meetings, check whether actions had been carried out, and explore whether there were follow up items resulting from those actions. In this sense minutes help individuals co-ordinate their own actions with each other and with what was publicly agreed. One manager commented:

It is like a checkpoint for me, just to make sure what we are doing is what we agreed we'd do at the last meeting. Are we still on track with what we said we'd do?

Minutes also serve as a long-term archive of the group's commitments and actions. Very occasionally teams would be asked about past events or commitments, and here the minutes were used as the document of record, stating what had been decided or what had been done about a particular issue.

A slightly different function of minutes was to remind people about their commitments. Here minutes serve as a 'todo' list for the various group members detailing their individual commitments. If those commitments have not been met, then other team members or the manager will invoke the minutes as way of enforcing that the action is carried out.

Minutes are an important record of what we said we'd do and when we said we'd do it. I go back to them when people aren't happy that a particular situation has occurred because someone hasn't done something they said they'd do.

This highlights a critical aspect of minutes - their use as an implicit contract between the different group members about the actions they each agreed to carry out. Managers or other team members will refer to the minutes as a way of questioning individuals about the status of one of their commitments.

> *It is generally where something has not happened or something has not gone to plan. Probably the key thing from my point of view is say two or three weeks after a meeting has taken place if somebody had agreed to take an action or do something and the situation has not improved or someone has escalated a problem I'll refer back to the meeting minutes to find out what was agreed and therefore what somebody should have done.*

The contractual nature of the minutes is further underlined by the practice we observed of having people 'sign off' on the minutes. Participants were encouraged to review the minutes of the prior meeting to correct discrepancies between what was written in the minutes and what participants recalled being discussed. These discrepancies need to be resolved before the minutes can become the official document of record. One manager semi-jokingly used quasi-legal language when giving team members the opportunity to approve or challenge the minutes: 'are these minutes a true and fair record of what happened on 24/11?'

In a similar contractual way, minutes are used as the document of record to resolve group disputes. There were occasional disagreements between team members about what had been decided. Usually the disputes focused on who had agreed to undertake an action item. When this happened, rather than relying on memory, the minutes were used to determine what was agreed:

> *I think you find over time that some people are generally more honourable about what they have said than other people, so some people you can trust what they have said and that they'll do things, other people will change there mind over time about what they said they would do and I think perhaps where I have felt in the past that someone has said something in a meeting and then backed away from it or not done what they have said then I'll generally capture what they have said or done and I'll make sure it is minuted.*

3.2 The Limitations of Public Records

Although minutes had clear benefits in serving as a group contract and memory aid, they nevertheless had several critical failings, including:

- Not all meetings had minutes taken.
- The minutes are occasionally inaccurate.
- The minutes lack sufficient detail to allow participants to carry out personal actions or to allow non-attendees to determine what went on in the meeting.
- They are selective sometimes omitting politically sensitive information.
- They are not timely.
- They are laborious to produce.
- They don't capture the experience of being in the meeting.
- They don't capture more peripheral aspects of the meeting such as 'awareness' information that is relevant to the group's functioning but not directly related to a decision or action.

Only 56% of the meetings that we observed had minutes taken. This seemed to depend on factors such as importance, meeting context and meeting type. Minutes were taken more often in the software than the delivery company. A possible reason for this was that the software meetings were contractual in nature involving discussions between customers and suppliers, where various promises were being made about what services would be delivered. Both parties felt that it was advantageous for decisions and commitments to be a matter of record. When there were no minutes participants relied on the manager's notes if these were available, or a combination of different team members' personal notes.

However, even when minutes were taken, participants complained that they had significant limitations. They pointed out that minutes were sometimes inaccurate. All participants routinely checked meeting minutes against what they had personally noted or remembered. They stated this was because important information was occasionally misstated or misrepresented in the minutes. These inaccuracies could arise because a discussion was complex, or poorly structured, or when the official minute-taker was not an expert in the topic under discussion. Inaccuracy is clearly a serious problem if minutes are being used both as a group archive and a contract between members about what they have agreed to do.

> *if someone else had taken a key action in a meeting I would make a note of that possibly, mainly to compare with the minutes of the meeting when they come out to check whether the meeting minutes were accurate particularly when I think something important or significant has been agreed.*

Another major problem was that public minutes often did not provide enough information to allow participants to carry out their individual commitments. Bare statements of action items and who was responsible for each, often did not provide enough background contextual information, making it hard for participants to carry out their action items.

> *I take notes because the minutes sometimes don't tell me everything I need to know about my own actions.*

Lack of detail also meant that it wasn't always clear even to attendees exactly what had happened in the meeting:

> *if you don't have a more detailed record of the meeting that sometimes you lose the meaning, you lose a lot of the richness about what happened so if you just see actions it doesn't always give you a clear view of what was discussed.*

This lack of detail made it even harder for non-attendees to use the minutes to discover what went on at a meeting.

> *Well normally minutes aren't enough, you need someone to give you a briefing afterwards, because the minutes don't tell you everything that has gone on and the discussions that took place.*

The minimal nature of minutes also made it hard to revisit prior decisions or reuse prior work. We asked participants whether they ever referred to past minutes when a related issue had occurred in a prior meeting. Again the minutes were felt to be too cursory - providing insufficient context about what had been discussed to make them useful.

Another limitation is that minutes can be selective, containing deliberate omissions such as when there is a politically sensitive discussion. We noted several such 'off record' discussions which were sometimes prefaced by instructing the minute-taker not to minute subsequent comments. Though these off-record comments often contained significant information (on one occasion, unofficial confirmation of a £3.6 million contract was discussed), this was not recorded and was therefore unavailable to non-attendees.

Another factor that undermined the utility of minutes as a group 'todo' list was that they were not timely, often taking several days to produce. If individuals relied on the minutes as a reminder about their outstanding actions, then several days might elapse before they can begin those actions. This not only left them with less time to execute actions before the next meeting, and but also increased the likelihood that they might forget important details associated with those items, especially as minutes tended to record minimal information about each action.

A further problem with minutes is that they are laborious to produce. A meeting participant has to be delegated to take highly detailed notes, reducing their ability to contribute. In addition, transposing these detailed notes, possibly checking their accuracy with various stake-holders, all means additional work.

A less frequently mentioned limit of minutes was they didn't recreate the feeling of being in the meeting. Two participants mentioned wanting records that were richer than descriptions of decisions and actions, saying they wanted to be able to reconstruct the meeting context and what it felt like to be at it:

> *it's just not remembering a list of some key points from a meeting but being able to transport yourself back in some instances if you are discussing what happened, so it is more of a transporting your memory back into the actual situation to remember the actual discussion to remember what actually happened.*

Another limitation of minutes related to their focus on decisions, actions and commitments. Participants pointed out that a key part of meetings is to provide awareness information, unrelated to specific actions or decisions but which provides a backdrop to the group's activities. Examples here included personnel changes in other groups or high level management. A related point was that an important function of meetings was to establish a culture or modus operandi for the group and that this type of information never appeared in the minutes.

3.3 The Nature and Function of Personal Meeting Records

Participants addressed some of the limitations of public records by taking their own personal notes. 63% of our informants reported that they 'always' took personal notes. The remaining 37% said that they 'sometimes' did so, and pointed to various factors such as chairing meetings - which prevented them from taking their own notes.

It was clear that personal records were highly valued. Most participants routinely took personal notes, which were always accessed, often multiple times. All informants reported referring back to meeting records at least once - with 75% of doing this 'frequently'. Another sign of their importance was that informants took great care to ensure that they were accurate. Half of them 'occasionally' rewrote their notes. Others stated a desire to rewrite their own notes but lacked the time to do this. They also took care to preserve their notes; 75% filed meeting records, keeping these records for a year on average.

Personal notes generally had a less predictable structure than minutes. Like minutes, personal notes mentioned important decisions, names, dates and actions. However one major difference was that personal notes reflected the note-taker's personal perspective, unlike the minutes - which were a general and often formulaic record of what transpired in the meeting.

I think my notes are a reflection of the things that interest me, the things that are of a particular interest to me in the meeting. When people are talking but I'm not interested that I don't note anything. My notes are subjective.

These comments were also supported by our observations, where it was clear that different participants took personal notes at different times and about different agenda items.

In their personal notes, participants often supplemented information about group decisions and actions with detailed factual information they thought they might forget, or which was relevant to the execution of their own personal actions. For example, participants might note personal actions on the right of the page with supporting information on the left. People might also note down actions associated with others if these had relevance for their own activities.

We analysed the content of people's notes. We classified each note depending on whether it concerned decisions, actions, or contextual information. Consistent with minutes, we found that a significant proportion of personal notes concerned decisions (19%) and actions (48%). However in contrast to minutes, we found that 30% of personal notes concerned comments supplying context for actions.

Another characteristic of personal notes is that they could be cryptic, often consisting of a few words about a topic. There are two main reasons for this. Firstly participants are aware that taking detailed notes detracts from their ability to contribute to the discussion, so they write as little as possible. Secondly personal notes are intended to be associative triggers or reminders for the note-taker, rather than verbatim transcripts of exactly what was said. If a participant is highly familiar with a given topic, or if a discussion outcome is exactly what they anticipated, then there is no need to record detailed information, if one or two carefully chosen words will suffice.

I don't usually write in sentences sometimes I just write one word that will be enough for me to remember what it was about.

People's roles also had an important effect on their note-taking. Managers tended to be involved in discussions around most agenda points which meant that they had fewer opportunities to take detailed notes. Note taking strategies were also influenced by whether or not the meeting was being minuted. Specifically, if participants knew that public notes were being taken they tended to take fewer notes.

these days I probably tend to take very few notes from meetings generally just things that are of importance to me or actions that I have taken out of a meeting, generally most important meetings would tend to be minuted anyway so I tend to rely on the minutes of the meeting.

We identified four main reasons why personal records were important to meeting participants:

- As personal reminders.
- To provide enough contextual information to carry out personal actions.
- To check the accuracy of the minutes.
- To brief others about what went on.

We have already seen that a major function of meetings is to agree on various actions that participants will carry out. People therefore take notes to remind themselves about what actions they have committed to. We have seen too, however, that the official minutes may contain insufficient contextual information to allow participants to carry out their actions. The need for context about personal actions explains why personal notes tend to be esoteric and personalised; notes are intended to help participants carry out their own jobs rather than serving as a general public record. In other words, personal notes serve to record personal 'todo' items and their context, which participants fear they may otherwise forget:

if I failed to [carry out the action] immediately as time goes on it would start to slip out, there could be key points that I forget, or key actions that I forget to take. With a recorded note I can always check and make sure I've done them, or check what I have to do.

When no official minutes were taken of the meeting, then personal notes were sometimes shared among attendees to ensure that commitments were not forgotten:

I have so many meetings I would forget what happened if I didn't write them down. It is a memory aid for me and quite often it is a memory aid for other people at meetings so quite often other people will come to me and ask me what happened and I'll check my notes and see what I have written down.

Another important function of personal notes is to check the accuracy of the meeting minutes. All our participants reported using personal notes for this purpose. As the minutes are used both as the document of record and also as a group 'todo' list, participants were keen to ensure that they were accurate, particularly about issues relating to themselves. For 25% of participants checking the minutes was the main function of their notes; after checking the minutes they discarded their own notes.

Finally, personal notes were sometimes used to report what went on in a meeting to non-attendees. However, when personal notes were taken to brief non-attendees, they tended to be less cryptic or personalised. Here note-takers felt they had to provide greater details of all aspects of the meeting that were thought to be relevant to the group being briefed.

3.4 The Limitations of Personal Records

Despite the value of personal notes, participants also complained about their limitations:

- Taking notes reduces one's ability to contribute to discussion
- Personal notes sometimes lack both accuracy and comprehensibility
- Their esoteric nature made them difficult for non-attendees to understand

One major problem was that taking accurate personal notes reduced participants' ability to participate in discussion. Participants' estimates of the time they took note-taking in meetings ranged from 5-40%, and all felt that this compromised their contributions:

if you are writing things down you are not listening to what is being said and it is probably more important to listen to what is being said rather than writing your own notes about things that have been discussed previously.

Indeed one of our informants pointed out that when he was chairing a meeting, he was so focused on the conversation and management of the meeting that he found it impossible to take notes.

This view is supported by our observations of informants. We noted down the frequency of note-taking and contributions to the meeting, and confirmed the expected negative impact of note-taking on people's contributions, with those taking detailed notes contributing least to the conversation

A second limitation of personal notes was that they were sometimes inaccurate or hard to interpret - even for those who had created them. One reason for this was the difficulty of simultaneously taking notes while listening to what is currently being said. Participants found themselves unable to process new information while writing detailed notes about an important prior point. The result was that personal notes could be cursory, disjointed and incomplete.

> *I can't understand my notes all the time probably because I have started to write down what I think I need to capture but then I have heard something else that has stopped me in my tracks, so what I have already written isn't joined up enough to understand what I was supposed to be capturing in the first place.*

Others focused on trying to take fairly minimal notes, allowing them to contribute to and track the conversation, relying on their memories to reconstruct what went on. Again however there are limits to this strategy as such notes often weren't detailed or accurate enough to determine what went on in the meeting or what actions to undertake as follow up.

4 Technological Implications

The observations detailed above have shown that there are clear problems associated with current techniques for the production and use of public and personal meeting records. In a previous paper [7], the state of the art of technology designed to review automatically produced meeting records was examined. Briefly, such systems primarily make audio and video recordings of meetings (although participant notes taken, projected slides, and whiteboard annotations are also often recorded) and then construct indices using raw data which allow users of meeting browsers to access and navigate the meeting record.

As a result of the analysis of current meeting records we are now in a position to critique current meeting browsers with regard to their support for public and personal recordings. It is clear that, in order to be beneficial, browsers should support current record taking practices while addressing their main problems. Below, current meeting browsers are assessed with regard to public and personal meeting records in turn.

4.1 Public Meeting Records

Current meeting browsers are highly focused on *single meetings* and are, therefore, poorly placed to support the collection of data from a long-term series of meetings. In cases where browsers make use of multiple meetings as a raw data set (e.g. [9]) the user is required to search the meeting set in order to identify a point of interest. There is little opportunity to perform a high level analysis on the meeting series; for example, tracking the progress of a task assigned in one meeting over a series of meetings.

Equally, the use of public meeting records as a record of past actions and decisions is not well supported by current meeting browsers. The core of the problem in this area is that there is no associated abstraction over each meeting, similar to the abstract representation of actions and decisions seen in the meeting minutes. There is a further question regarding the *formality* of the meeting record. Recall that one of the uses of public records was as a contractual record of the events of a meeting. It is unlikely, due to the errorful nature of automatically recognised speech, whether such a formal summary of the meeting could be produced. It is unclear, too, whether the verbatim record is too fine grained to perform the same function. It is also unclear whether hybrid access to the meeting record (e.g. [8]) would prove effective. If a more concrete abstract record is required, however, it is likely that browsers could be employed as a tool to clarify and identify key points.

Although current meeting browsers have difficulty in matching the benefits of current public meeting records they are able to overcome some of the problems associated with such records. Most notably since the meeting record is automatically produced public records are no longer laborious to produce, selective, or untimely (although there is some delay in constructing the indices; for example, the transcript is generally produced off line). Furthermore, although there may be errors in the automatically generated annotations, the underlying recording is accurate; any inaccuracies in the annotations can be resolved by reverting to the original recording. It is also possible to determine contextual information, if it is assumed that the indices provided are suitable for locating the relevant points in the meeting.

It is also easier to generate automatic records for all meetings, since a chosen minute taker is no longer required; this also means that the minuter can increase their contribution to the meeting. Most meeting recording systems are, however, designed for a specific room where the setup and calibration of the recording equipment is relatively straightforward to maintain. There is, therefore, a requirement that, to be recorded, meetings take place in this specific room. This precludes spontaneous meetings which research has shown are prevalent [4]. A novel approach to addressing this problem is outlined in [10], with the use of a portable recording device which allows for audio and video recording; whiteboard annotations, notes etc. are not included in this recording.

Finally, it is difficult to say whether browsing a meeting will account for the more peripheral experiences in which the public records were described to be lacking. It is clear that the inclusion of audio-visual recordings should increase the experience of attending the meeting compared with a textual record and, since a verbatim record is produced, no information is lost in the meeting record. Novel browsers which aim to construct virtual meeting spaces (e.g. [11]) may be required to fully present an immersive meeting review environment.

4.2 Personal meeting records

Personal meeting records are less concerned with providing information for long-term analysis and so the supplementation of these records is less problematic for current meeting browsers. The personalised nature of such records are not often reflected in meeting browsers, however mappings between personal notes and meeting records are well described in the literature (e.g. [2]). Filochat [14], for example, allows the user to take notes as they normally would, these notes then acting as an index into a recording of the meeting. Whilst such systems are typically successful, current media rich meeting browsers (e.g. [13,6,13]) do not yet leverage the use of this functionality - although it is likely that personal notes could form an index which could be used by such browsers.

Most of the benefits of personal notes such as providing contextual information, to check the accuracy of public records and to brief others about the meeting are addressed by current meeting browsers. However, current meeting browsers are built around low level annotations (e.g. speaker turns, presented slides etc.) and do not support the extraction of personal actions. Browsers which index personal notes taken during the meeting can support this process but the support is inherently indirect. In Filochat, for example, there is no explicit way of qualifying the purpose of the each note - the user must generate their own notation to achieve this. It is possible that, in the future, text processing techniques can be used to determine the purpose of each note and can supplement these indices

Personal records are no longer required to brief others about the meeting since non-attendees can now just have access the meeting record. Again, however, the problem of abstraction is raised since a non-attendee has no means of quickly determining the salient points of a meeting; for example, there is no means of identifying the actions that were assigned to them. The problem of personal notes being too esoteric for sharing no longer applies and, furthermore, there is arguably considerable information to be gathered from a group analysis of note taking practices of the meeting participants [14] that would not be possible without the automatic processing.

A significant problem with personal notes, as noted in our observations, was that taking notes reduces the ability to participate in the meeting. Whilst meeting browsers do not necessarily negate the need to take notes, it can be seen that the time required to note something is significantly reduced if personal notes are being used to construct an index into the meeting since the note need not include all the contextual information required [2,4].

4.3 Summary

Due to the reciprocal nature of public and personal meeting records, the current generation of meeting browsers are largely able to both address the limitations of public records and replicate the benefits of personal records. The main failings of meeting browsers seem to be that they are largely only able to offer a view of a single meeting, that there is not layer of abstraction between the user and the underlying data and annotations and finally that data collected from personal notes are not exploited in media rich meeting browsers. Furthermore, an unanswered question is whether a formal set of minutes are required now that users have access to the verbatim record.

5 Conclusion

Our study shows how two types of public and personal record are used together to co-ordinate different aspects of collaborative activity. Minutes are a minimal description of collectively agreed actions and decisions serving as a contract and group archive. However individuals supplement these with personal notes that are customised, providing themselves with information that allows them to carry out their personal objectives, as well as to check the veracity of the official minutes. Our analysis of new technical opportunities indicates that current browsers lack abstractions but there is much leverage to be gained by exploiting more data sources.

6 Acknowledgements

This work was partly supported by the European Union 6th FWP IST Integrated Project

AMI (Augmented Multi-party Interaction, FP6-506811, publication AMI-97).

References

1. Green, W.A., and Lazarus, H.: Are today's executives meeting with success, Journal of Management Development (10) 1, (1991), 14-25.
2. Moran, T.P., Palen, L., Harrison, S., Chiu, P., Kimber, D., Minneman, S., Melle, W. and Zellweger, P.:"I'll get that off the audio": A Case study of salvaging multimedia meeting records. In: Proceedings of the CHI '97, Atlanta, Georgia (1997).
3. Wilcox, L., Schilit, B.N., and Sawhney, N.: Dynomite: A Dynamically Organized Ink And Audio Notebook. In: Proceedings of CHI 97, Atlanta, Georgia (1997).
4. Whittaker, S., P. Hyland, and M. Wiley: Filochat: Handwritten Notes Provide Access To Recorded Conversations. In: Proceedings of CHI '94, Boston, Massachusetts, USA (1994).
5. Chiu, P., Boreczky, J., Girgensohn, A., Kimber, D.: LiteMinutes: An Internet-Based System For Multimedia Meeting Minutes. In: Proceedings of 10th WWW Conference, Hong Kong (2001) 140-149.
6. Cutler, R., Rui, Y., Gupta, A., Cadiz, J.J., Tashev, I., He, L., Colburn, A., Zhang, Z., Liu, Z. and Silverberg, S.: Distributed Meetings: A Meeting Capture And Broadcasting System. In: Proc. of the 10th ACM International Conference on Multimedia (2002), 503-512.
7. Tucker, S., Whittaker, S.: Accessing Multimodal Meeting Data: Systems, Problems and Possibilities, In: Bengio, S., Bourlard, H. (Eds.) Lecture Notes In Computer Science, 3361, (2005) 1-11.
8. Whittaker, S., Hitschberg, J., Amento, B., Stark, L., Bacchiani, M., Isenhour, P., Stead, L., Zamchick, G., Rosenberg, A.: SCANMail: A Voicemail Interface That Makes Speech Browsable, Readable and Searchable. In: Proceedings of CHI 2002, Minneapolis, Minnesota, USA (2002)
9. Colbath, S. and Kubala, F.: Rough 'n' Ready: A Meeting Recorder and Browser. In: Proceedings of the Perceptual User Interface Conference, November 1998, San Francisco, CA. (1998), 220-223
10. Lee, D., Erol, B., Graham, J., Hull, J.J., and Murata, N.:, Portable Meeting Recorder. In: Proceedings of the ACM Multimedia (2002), 493-502.
11. Reidsma, D., Akker, R., Rienks, R., Poppe, R., Poppe, R., Nijholt, A., Heylen, D. and Zwiers, J.: Virtual Meeting Rooms: From Observation to Simulation. In: Proceedings of Social Intelligence Design, (2005).
12. Wellner, P., Flynn, M. and Guillemot, M.: Browsing Recordings of Multi-party Interactions in Ambient Intelligent Environments, In: CHI 2004 Workshop #9: Lost in Ambient Intelligence, (2004).
13. Lalanne, D., Sire, S., Ingold, R., Behera, A., Mekhaldi, D. and Rotz, D: A Research Agenda For Assessing The Utility Of Document Annotations In Multimedia Databases Of Meeting Recordings. In: Proceedings of the 3rd International Workshop on Multimedia Data And Document Engineering, Berlin, Germany (2003).
14. Davis, R.C., Landay, J.A., Chen, V., Huang, J., Lee, R.B., Li, F.C., Lin, J., Morrey, C.B., Schleimer, B., Price, M.N., Schilit, B.N.:NotePals: Lightweight Sharing by the Group, for the Group, In: Proceedings of CHI 99, (1999) 338-345.