# The Necessity of a Meeting Recording and Playback System, and the Benefit of Topic–Level Annotations to Meeting Browsing

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**Abstract.** Much work in the area of Computer Supported Cooperative Work (CSCW) has targeted the problem of supporting meetings between collaborators who are non-collocated, enabling meetings to transcend boundaries of space. In this paper, we explore the beginnings of a proposed solution for allowing meetings to transcend time as well. The need for such a solution is motivated by a user survey in which busy professionals are questioned about meetings they have either missed or forgotten the important details about after the fact. Our proposed solution allows these professionals to transcend time in a sense by revisiting a recorded meeting that has been structured for quick retrieval of sought information. Such a solution supports complete recovery of prior discussions, allowing needed information to be retrieved quickly, and thus potentially facilitating the effective continuation of discussions from the past. We evaluate the proposed solution with a formal user study in which we measure the impact of the proposed structural annotations on retrieval of information. The results of the study show that participants took significantly less time to retrieve the answers when they had access to discourse structure based annotation than in a control condition in which they had access only to unannotated video recordings ($p < 0.01$, effect size 0.94 standard deviations).

## 1   Introduction

Meetings in modern organizations play a crucial role as the forum where information is shared, alternatives are discussed, and decisions are made. Much research has therefore focused on facilitating the conduct of meetings when all the participants are not collocated (e.g., [10], [11], etc). A secondary role that meetings play is in the bringing together of a large amount of project–relevant information, and also being the source of new kinds of information (such as decisions, action items, etc). Some recent research has focused on capturing this information, both old and new, and making it available for later access by interested parties (e.g.: [1], [4], [7], etc.) Such technology has several potential uses. First it can be of use to parties that were absent during the actual meeting. While such *non–contemporaneous* meeting participants may not be able to contribute

to the meeting itself, they can at least benefit from the information discussed at the meeting using such technology, and then be included as a more informed participant in resulting ongoing discussions. A second use of this technology is as an aid to participants' memories of past meetings. Participants forget details of meetings, or worse, have erroneous recollections of past meetings. Meeting capture and play back technology, if appropriately designed, can be used to efficiently retrieve details of past meetings. Thus, this technology can be viewed as improving Organizational Memory [8], which has been shown to enhance productivity [9]. Note that recording meetings raises several privacy and confidentiality issues. Cutler and colleagues (2002) report finding that participants are "generally comfortable having their meetings recorded", although they caution that this could be the result of participant self selection in their pilot study.

Our first goal in this paper is to explore the problem of reconstructing information discussed at a meeting. How often do busy professionals need to reconstruct details of past meetings? What kinds of documents do they typically have access to? Are those documents sufficient? What kinds of information are they typically seeking from past meetings? How much time does it take to do the reconstruction? To gain an understanding of these issues, we have run an interview–based survey with 12 faculty members at Carnegie Mellon University. We have chosen this user population since university faculty typify professionals whose lives are dominated by meetings. Interviewees were asked to narrate specific instances of situations when they were trying to catch up on a meeting that they had missed, or were trying to reconstruct forgotten details of a meeting they had attended in the past.

Our second aim is to assess through a controlled study how helpful topic–level annotations are to meeting browsing. The Carnegie Mellon Meeting Recorder [1] can be used to create rich multi–modal records of meetings, while the MockBrow can be used to manually annotate a meeting record, and also play back both the meeting record and any associated annotations. Both these tools are being developed as a part of the CALO (Cognitive Agent that Learns and Organizes) project [14]. The ultimate goal is for the discourse structure based annotation that we evaluate the utility of in this paper to be applied to recordings of meetings automatically by making use of easily detectable cues such as shifts in word frequency distributions that are indicative of topic shifts.

## 2    Related Work

Three previously published lines of research form the foundation for the investigations reported in this paper.

The Distributed Meetings (DM) project [4] involves a system that can be used to broadcast and record meetings, and also view pre–recorded meetings. Unlike our system, the DM does not attempt to automatically identify the structure of the meeting. Cutler and colleagues (2002) evaluated the DM by conducting a user study involving real meetings between real participants at Microsoft Research. At each meeting, a person was asked to remain absent, and to later come in

and view the meeting recording using the DM viewing software, and then fill out a questionnaire. The questionnaire data did not present a strong case for the desirability of the solution although it did provide evidence that users were satisfied with the information they received from it. What the paper lacks that we attempt to provide is insight into the specific types of information needs people have regarding missed or forgotten meetings.

Another similar project is the WorkspaceNavigator [5] that attempts to capture many different sources of digital information as a meeting proceeds inside a "smart room". Recording involves taking regular snapshots of different computer displays, the meeting room itself, filenames of open files and URLs of visited web pages from participant laptops, etc. Users are allowed to label the snapshots, or just mark snapshots as being important as they are being recorded. Two qualitative user studies were conducted to provide a detailed view of patterns of actual use of the technology. The paper provides convincing evidence that users were able to index and retrieve portions of meetings when needed. What this previous paper lacks that we offer in this paper is a controlled experiment in which the magnitude of the impact of a general class of annotations on the speed of information retrieval from meeting recordings is precisely measured.

Closely related to our project is the survey [6] of potential users of a meeting browser, conducted as a part of the IM2.MDM (Interactive Multi-modal Information Management, Multi-modal Dialogue Management) project. The goal of this survey was to elicit a set of questions that users may ask of an intelligent meeting browser. While this survey provides some broad insights, it differs from ours in both its goals and its methodologies, especially in that it does not adhere to strong HCI methodology for survey research. One of the goals of our survey is to assess how *useful* a meeting browser would be, how urgently its need is currently felt by busy professionals, and in what range of their actual situations they could potentially benefit from the use of a meeting browser. In contrast, the survey reported in [6] makes the implicit assumption that if busy professionals had access to an intelligent meeting browser, they would indeed use it! In our survey interviewees were asked to recall recent instances of actual situations. The resulting analysis of the interviews is therefore grounded in real experiences as opposed to potentially erroneous generalizations. The survey questionnaire in [6] asked participants to imagine themselves in a situation they have never been in before, namely, in possession of a system using which they could "ask questions about the actual content of the meeting". Thus, it is not clear how many of the questions collected in that study would indeed be asked by users of a future meeting browser in actual use.

## 3   User Survey

### 3.1   Goals

Efforts towards creating a meeting recording and play–back system can clearly drive research on a large number of fronts including speech recognition, spoken

language understanding, vision–based gesture recognition, multi–modal information integration, and others. In this paper, however, we are interested in evaluating whether there is a *need* for such a meeting browsing application. Intuitively, such an application would be useful to busy professionals who need to catch up on missed meetings or recall forgotten details of meetings they have attended in the past. To understand how professionals currently perform these tasks we have conducted an interview based survey. Specifically, the survey was conducted to find answers to the following questions:

- How often do busy professionals miss important meetings that they need to catch up on?
- How often do users need to reconstruct forgotten details of meetings they did attend?
- What kind of information/documents do they typically have access to in each of the above two cases?
- What kind of information do they typically seek?
- What processes do users currently employ in obtaining this information and how effective/costly are they?

### 3.2   Survey Methodology

Our survey was based on face–to–face interviews conducted with 12 faculty members at Carnegie Mellon University. We chose faculty members since they attend many meetings as a part of their daily routine, and would be the likely targets of a meeting recording and playback application. Since not all missed meetings are important enough to bother catching up on, we defined a meeting as *important* if the interviewee indicated that he would indeed make an attempt to find out about it if he missed it. Interviewees were asked to describe instances of two kinds of situations: situations when they had missed important meetings, and those in which they were trying to recollect details of a meeting they had attended in the past. For each instance, interviewees were asked to name and describe the meeting artifacts they had access to, what specific pieces of information they were seeking about the meeting, whether and how they found the information, and whether they were satisfied with the information they did find. To avoid bias, interviewees were not informed about the reasons for this interview until the very end of the interview. To ground the interview in real experiences, interviewees were strongly and repeatedly encouraged to avoid replying in potentially erroneous generalities, and instead were asked to recall specific situations from their experiences in answering questions.

### 3.3   Analysis of Non-missed Meetings

The 12 interviewees reported a total of 19 instances of situations when they were attempting to recall details of a meeting they had attended in the past (1 interviewee reported no such instances, 3 interviewees reported 1 each, and the rest reported 2 each). Interviewees were asked to report both when they were attempting to recall details of a past meeting, as well as when the meeting took place (which was normally within the past few months).

**Information Sought from a Meeting:** Interviewees were asked to specify the information they were attempting to reconstruct about the meeting; table 1 lists the frequencies of the various categories of information sought across all the instances of non–missed meetings reported by the interviewees. Note that interviewees were not shown the categories listed in the table, but were simply asked to recall all the pieces of information they were seeking about the meeting. These answers were later manually clustered into the groups in table 1. For example, the category *Specifics of the discussion on a topic* include questions like "What was the name of the algorithm we discussed?". These categories are not directly comparable to the questions generated by the study in [6] which asked respondents to visualize scenarios where they had *missed meetings*.

While interviewees were not specifically asked to explain why they needed the information they were seeking, for several of the 7 instances of the category *What the decision was regarding a particular topic*, interviewees spontaneously mentioned that the reason they were attempting to recall the decision was not because they thought they had forgotten the detail, but because their recollection of the detail differed from that of another co-participant of that meeting. We believe that this phenomenon of needing verification of information is an important motivation for meeting recording and play–back technology.

**Table 1.** Information Sought from Meeting

| Information sought | # meetings |
|---|---|
| Specifics of the discussion on a topic | 11 |
| What the decision was regarding a particular topic | 7 |
| What task someone else was assigned | 4 |
| Who made a particular decision | 2 |
| What the participants' reactions were to a particular topic | 1 |
| What the future plan is | 1 |

**Reconstructing from Available Documents:** The interviewee was asked to list the documents he had access to while he was attempting to make the reconstruction; table 2 lists the documents. In 14 of the 19 meetings, the users had access to notes taken at the meeting, typically the notes they had taken during the meeting. In the remaining instances, interviewees had not taken notes at the meeting, and further did not have access to notes taken by any other meeting participants. Interviewees were also asked to rate on a scale of 0 to 5 whether the piece of information they sought about the meeting was satisfactorily answered by the meeting documents they had at their disposal, where 0 implied their question remained unanswered, and 5 implied they were completely satisfied with the answer they got. The average rating was 3.0 (std. dev.: 1.7).

**Additional Steps Taken to Find Information:** Interviewees were asked what additional steps (besides perusing the meeting documents) they took to find

**Table 2.** Documents the Interviewee Had Access To

| Documents interview had access to | # meetings |
|---|---|
| Notes | 14 |
| Nothing | 2 |
| Minutes | 1 |
| PowerPoint Slides | 1 |
| Excel Sheet | 1 |
| Project proposal document | 1 |
| Whiteboard content | 1 |
| Email | 1 |

the information they needed from the meetings. In 8 cases the interviewees asked someone in a face–to–face conversation. This was particularly the case when the question was about a specific detail about the meeting. In 5 cases interviewees reported that they reconstructed from memory, in consultation with a meeting co–participant (note that this is not the same as simply *asking* someone else about a detail). Finally interviewees were asked to rate on a scale of 0 to 5 their quality of reconstruction of the information they were seeking, after they took the additional steps, where 0 implied they could not do any reconstruction at all. The average rating was 4.0 (std. dev.: 0.6) – this was significantly higher than the satisfaction before perusing the meeting documents ($p < 0.0005$). 5 interviewees stated that the additional steps took less than 15 minutes, 7 said between 15 minutes and an hour, while for 2 interviewees, the additional steps took more than an hour.

**Summary and Conclusions:**

- Interviewees mostly sought very detailed pieces of information from the meetings they had attended in the past.
- Very often the interviewees had access to notes that they could consult.
- Interviewees sometimes felt satisfied with the information they were able to retrieve from available documents.
- When the documents did not suffice, interviewees spoke to co–participants, or took other additional steps, which took up to an hour of time. At the end of these steps, interviewees largely felt that their information needs had been satisfied. Nevertheless, this does not guarantee that the information that they received was accurate since meeting co-participants may have different recollections of what was discussed at a meeting.

### 3.4   Analysis of Missed Meetings

The 12 interviewees reported a total of 22 instances of meetings they had missed in the past that they needed to catch up on. 9 interviewees reported 2 instances each, while 1 interviewee reported 3, 1 2, and 1 none (that is, one interviewee

could not recall any specific instance of an important meeting that he had missed and later attempted to catch up on). 2 of these 22 missed meetings had occurred in the week prior to the interview, while 10 had occurred within the preceding month. Thus, on average interviewees reported missing one important meeting in the month prior to being interviewed. Of the remaining instances, 9 had occurred within six months prior to the interviews, and 1 between six months to a year before the interview. Note that based on the frequency of missed important meetings reported within the month prior to the survey, it would not be unrealistic to estimate that the population used in the survey misses on average about 1 important meeting per month.

**Understanding of Expected Meeting Content Prior to Meeting:** A person's overall understanding of the information discussed at a meeting is likely to be affected by his prior knowledge and expectations about the meeting before it takes place. Of the 22 reported instances of missed meetings, in 2 cases the interviewee did not receive any notification about the meeting (such as an email announcing the meeting). In one of these cases the meeting had already taken place by the time the interviewee received the notification, while in the other case the meeting was a regularly scheduled one and notifications weren't usually sent out. In 12 of the remaining cases the interviewee received an agenda and/or a description of what would be discussed, while in the remaining cases he received a notification email announcing the meeting. Each interviewee was asked to rate on a scale of 0 to 5 how well he felt he knew the contents of the meeting would be, where 0 implied he had no idea what the contents would be, and 5 meant he knew exactly what would be discussed. The average rating was 3.5 (std. dev.: 1.3).

**Information Sought from a Missed Meeting:** For each instance of reported missed meetings, interviewees were asked why they wanted to catch up on the meeting. In particular, they were asked to list all the pieces of information they needed from each missed meeting. Table 3 presents the frequency of each category of information sought by the interviewees across all the instances of missed meetings. Thus in 10 of the 22 missed meetings, the interviewee wished to find out what was discussed about a specific topic. As with non–missed meetings, participants were not provided with the categories in table 3; the categories were constructed based on their responses.

Observe that the first 3 categories in table 3 together make up the majority of categories of information sought about missed meetings; note also that these three categories are related in that they are all concerned with seeking information about a particular topic of interest. This suggests that when a person misses a meeting, he is often more interested in catching up on the discussions regarding a specific topic of interest rather than the entire meeting. Thus, perhaps an automated topic detection and segmentation mechanism that lets the viewer of a recorded meeting focus only on the topic he is interested in will be well received.

The most salient difference between the questions asked in "real world" situations by our interviewees and the questions proposed by [6] is that none of

our interviewees reported asking any "hard" questions that require deep under-
standing of the meeting context, such as "3-Y-7-2 Why X changed his mind on
issue Y in the current meeting?", or "3-N-5-9 Why was topic #5 not resolved?"
([6]). We believe this is the case because when people miss meetings, they are
unlikely to be aware of enough context to ask these questions. That is, the user
will not ask why X changed his mind if he is unaware that X changed his mind.
Also, while it is possible to imagine that each of the large variety of questions
in [6] may be asked under some circumstance, perhaps these conditions are rare
enough that they did not arise in our limited set of interviews.

**Table 3.** Information Sought from Missed Meetings

| Information sought | # meetings |
|---|---|
| What was discussed about a particular topic | 10 |
| What decisions were made about a particular topic | 7 |
| Whether a particular topic was discussed | 5 |
| Whether I was assigned a new task | 4 |
| Whether a particular decision was made | 3 |
| What decisions were made | 2 |
| If there were any new issues/announcements | 2 |
| Reasons for a decision | 1 |
| What the participants' reactions were to a particular topic | 1 |
| The backgrounds of the other participants | 1 |

**Understanding of Meeting Content After the Meeting:** To understand
what kind of information about the meeting the interviewees could access with-
out having to make an effort at locating the information, we asked the interviewee
to list the documents he received from the meeting after the meeting took place,
*without him prompting for them*. Note that by "document" we included *any* piece
of information that the interviewee may have received without prompting, in-
cluding orally communicated information from other participants of the meeting,
emailed documents, etc. The aim in asking this question was to understand what
kind of documents are routinely sent around – one can presume that (at least
a large subset) of these documents would be available even when participants
have access to a meeting browsing system. Table 4 lists the documents reportedly
received by the interviewees. Observe that in more than half the meetings, no
document was received at all. Since these meetings are important enough to the
interviewee that he wants to catch up on them, not receiving any information
from the meeting implies that the interviewee is forced to either actively search
for information about the meeting, or give up and not learn anything about the
meeting at all.

Interviewees were further asked to rate on a scale of 0 to 5 how well the
documents they received (if any) answered their question(s) about the meeting,
where 0 meant they either did not receive any documents, or that the documents
they received did not answer their questions at all. The average rating was a very

low 1.7 (std. dev.: 1.9). This low number is partly explained by the fact that to a large extent interviewees received nothing from the meetings. In cases where the interviewee did receive notes etc from the meeting, they were often not sufficiently detailed to answer their questions regarding the meeting.

**Table 4.** Documents Received after the Meeting

| Post–meeting document received | # meetings |
|---|---|
| Nothing | 12 |
| Notes | 7 |
| Minutes | 3 |
| Email from meeting participant (not official notes) | 2 |
| Document containing draft of a proposal | 1 |

**Additional Steps Taken to Find Information from Missed Meeting**
Interviewees were asked what additional steps, if any, they took to find answers to their questions regarding the meetings. Table 5 shows the steps taken. Consistent with our findings about non-missed meetings, in connection with 15 meetings interviewees either asked someone face to face about the meeting, or emailed someone.

**Table 5.** Additional Steps Taken

| Additional step | # meetings |
|---|---|
| Asked someone face-to-face | 9 |
| Emailed someone | 6 |
| No additional steps | 5 |
| Caught up at next meeting | 3 |
| Looked up information on the Internet | 1 |

When asked how long these steps took, in 11 instances the interviewee said it took less then 15 minutes, in 5 cases between 15 minutes and an hour, and in 1 case more than an hour (this information was not collected for 5 instances). These times were self reported by the interviewees and are rough estimates only: the interviewees often reported having discussed other issues with their interlocutors while catching up on the missed meeting.

Finally the interviewees were asked to rate on a scale of 0 to 5 how much they believed their information need was met after taking the additional step, where 0 meant their information need was not met at all. The average rating in this case was 3.4 (std. dev.: 1.3).

**Summary and Conclusions:**

- Interviewees were more interested in catching up on discussion regarding specific topics rather than the entire meeting.
- Very often no documents were received, even though the meetings were important.
- Typically interviewees had a low level of understanding of the meeting from the documents received.
- Most interviewees attempted to answer their questions regarding the meeting by asking or emailing a co-participant. This extra effort took around 15 minutes.
- Even after taking additional steps to find information about the meeting, the interviewees' levels of understanding about the meeting were felt to be far from perfect.
- Based on the fact that information is often sorely lacking about a missed meeting, we conclude that a meeting recording and playback system would be useful for busy professionals to catch up on missed meetings. Further, if the meeting recording is segmented into discussion topics, users can focus on only their particular topics of interest, thus increasing their efficiency of extracting information from the meeting.

## 4   Meeting Browsing Using Topic Annotations

In the second part of this paper we report on our investigation into the effect of meeting annotation on the time it takes for a user to retrieve information from a meeting.

### 4.1   Meeting Annotation

We are interested in automatically detecting the structure of a meeting. For the purposes of this paper, we define meeting structure on two levels: A coarse level consisting of meeting states and participant roles, and a finer level consisting of discussion topics.

We build upon a previously published ontology of meeting states and participant roles [2] based on extended observation of natural meetings between human beings. In this ontology, there are three kinds of meetings states, as follows: (1) Discussion state, which is described as being a state in which a group of two or more meeting participants are involved in quick back and forth of discussion on a topic; (2) Presentation state, which is described as being a state in which one particular meeting participant is presenting information to the others in a formal setting; and (3) Briefing state, which is described as being a state where one participant is giving information to one or more meeting participants, but without involving either the formality of the presentation state, or the quick back and forth of the discussion state. Within each meeting state, the possible roles of the meeting participants are defined as follows: within the discussion state, participants may take the role of discussion participants or of the observer; within

the presentation state, presenter or observer are the two possibilities; and within the briefing state, information-provider, information consumer and observer are the possible roles.

Discussion topic regions are defined as all the times of the meeting that are devoted to discussing a certain topic. Although "topic" itself can be defined on various levels of granularity, in general we are interested in broad high level topics such as those that typically form different agenda items. For example "buying a printer" may be considered a topic. Research has been done on automatically finding topics both in written texts [13] and in broadcast news [12]. While we are currently applying the text topic detection techniques described in [13] to media recorded at meetings, in this paper we use only manually annotated meetings to ensure high quality topic boundaries.

## 4.2   Brief Description of the MockBrow

Meetings can be manually annotated using the meeting annotation and playback tool *MockBrow* implemented at Carnegie Mellon University. This tool allows human annotators to select a time interval within a recorded meeting and associate it with one or more labels. For example, an annotator may mark an interval of the meeting as being a "presentation", or as belonging to the discussion on "buying a printer", etc.

MockBrow is also intended as a platform to play back all the time–stamped media streams recorded at a meeting (such as close–talking microphone audio, video from multiple cameras, captured whiteboard markings, etc), along with all annotations generated either automatically or manually as described above. The interface allows viewers to quickly jump backwards and forwards within the meeting, as well as play only small portions of interest within the meeting. For example, a viewer may choose to only play back the portion of the meeting labeled as "buying a printer". Currently MockBrow does not support any automatic searching mechanism.

## 4.3   User Study Goals and Methodology

In order to assess the value of developing technology to automatically annotate meeting recordings with discourse structure based annotations in order to facilitate extracting information from recorded meetings, we designed a within subjects user study.

*Materials:* We created an audio-video record of two ten-minute-long meetings, each involving three participants. Next we manually annotated each meeting with meeting states, participant roles and discussion topics using MockBrow. The same meeting could then be viewed either with the annotations or without. Finally, based on findings from the questionnaire, we prepared for each meeting a set of five factual questions, with answers that are easy to evaluate the answer as correct or not. (To avoid biasing the questions, the annotations were not consulted while constructing the question set).

*Participants:* 16 Carnegie Mellon graduate students participated in the within subjects experiment. Note that while the survey was conducted on faculty members who would be the most likely target population for a meeting recording and playback application, the career status of the participants is not likely to affect the speed with which they are able to retrieve answers to questions that are provided for them from recorded meetings. Our plan is in the future to invite busy faculty members to participate in a long term longitudinal study of meeting recording and playback.

*Experimental Manipulation:* Each participant was asked to answer the questions for each of the two meetings by viewing the meeting's video using Mock-Brow while searching for the answers. In order to control for ordering effects, subjects were randomly assigned to 4 configurations in which half of the subjects viewed the first meeting and then the second meeting whereas the other half of the subjects viewed the meetings in the opposite order. Furthermore, half of the subjects viewed the annotated version of meeting one and the unannotated version of meeting two, whereas the other half of the subjects viewed the annotated version of meeting two and the unannotated version of meeting one.

In all cases, participants were encouraged to answer the questions as fast as possible, and their time to completion of each meeting viewing and question answering was recorded.

## 4.4   User Study Results and Analysis

The timing data collected in the experimental manipulation was sufficient for comparing average speed of answering questions with and without discourse structure based annotations. The control group (the group that did not have access to the annotations) took an average of 10.0 minutes (std. dev. = 2.6) to answer the given questions, while the experimental group took 7.5 minutes (std. dev. = 1.4). A two-tailed Student's T-Test assuming unequal variance shows that this difference in the means is significant with $p < 0.01$. Further the effect size (using the standard deviation of the control group as the denominator) is 0.94. This establishes that the difference in time taken to answer the questions when the participants could view the annotations versus when they could not is a reliable difference. Specifically, the annotations allowed participants to take on average 2.5 minutes less time to retrieve the answers to 5 questions in meetings that were 10 minutes long, when compared to those who had no access to the annotations.

In this experiment we did not record and analyze participants' browsing behavior. However it was clear that different participants used different strategies to retrieve information from the meeting record. When not provided with any annotations, some participants were content to listen to the entire meeting, while some others tried to randomly jump back and forth within the meeting. Several participants who did so complained that they had difficulty keeping track of which parts of the meeting they had already seen and which parts they had not. When provided with annotations, no participant viewed the entire meeting. Instead all participants viewed those annotated portions of the meeting they

believed they would find the answer in. In future work we plan to minutely record and observe participants' browsing behavior to find useful patterns.

## 5   Conclusions and Future Work

In the first part of this paper, we have reported on a user survey aimed at understanding how busy professionals such as faculty members deal with situations when they are attempting to catch up on missed meetings, or attempting to recall details of meetings they have attended in the past. One important finding was that the busy professions participating in our survey research missed on average 1 important meeting per month. Furthermore, they frequently discovered that their recollection of a discussion at a meeting was not consistent with another group member's recollection. The most frequent recourse when faced with a perceived need to recover meeting was to talk to a group member who was at the meeting. However, even in the case where people felt satisfied with the information received from a group member, it is not clear to what extent the information they receive based on another's recollection is accurate. Thus, the survey research provides some support for the usefulness of a meeting browser. It also provides an ontology of question types that represent the types of information typically sought by our target user population.

In the second part of this paper we have reported on a within-subjects user study performed to quantify the impact that discourse structure based annotations have on the time it takes users to retrieve the answers to focused questions from recorded meetings. We have shown that in our experiment, participants on average took 2.5 minutes less to find answers when given the annotations than when not, and that this is a highly significant difference ($p < 0.01$ using Students' two tailed T-Test, assuming unequal variance). This encouraging result is only a first step towards understanding the impact of discourse based annotations on retrieval of information from recorded meetings. We plan to perform a larger study with longer meetings, and with two populations of participants – those who have been in the meeting and need to recall details about the meeting, and those that have missed the meeting and need to find out about the meeting. As a part of this larger "real–world" experiment we will also be able to investigate potential privacy issues with recording meetings, such as answering questions.

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