Video Threads: Asynchronous Video Sharing for Temporally Distributed Teams

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ABSTRACT
Work teams are often geographically distributed, and in some cases, experience large time-zone differences with no overlap in working hours. We explored the use of asynchronous video in temporally distributed teams. We developed VideoThreads, which provides a novel thread-based visualization of video messages. Based on a deployment to four teams, we offer design recommendations and insights about the benefits of asynchronous video sharing.

Author Keywords
Computer-mediated-communication, video, asynchronous, CSCW, time-shifted collaboration, office and workspace.

ACM Classification Keywords
H5.3. Group and Organization Interfaces (CSCW).

General Terms
Design; Human Factors; Management

INTRODUCTION

Workgroups are often geographically distributed and can span large time-zones. Temporal and geographic dispersion can complicate group-based communication as various cues and signals available in face-to-face interaction are absent.

When there is some overlap in normal working hours, teams can schedule synchronous communication. However, not all teams have this luxury. A number of text-based asynchronous communication tools exist to help distributed teams work together more effectively. Such media, however, do not necessarily facilitate nuanced communication.

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The goal of our research is to explore whether asynchronous video conversations could be beneficial to temporally distributed teams, and how they might be used. The contributions of this work are three-fold: we introduce a thread-based visualization tool to manage asynchronous video conversations, we contribute an understanding of how temporally distributed teams use asynchronous video, and we provide design recommendations for asynchronous video messaging tools.

TEMPORALLY DISTRIBUTED TEAMS

Distributed Team Communication

Distributed team communication has been studied extensively [1, 11, 13]. Grinter et al., found that team members could mitigate some coordination challenges by using their personal networks nurtured by face-to-face time [5]. They also found that cross-site work has interdependencies that introduce delays [6, 7]. In comparing video to face-to-face communication, Issacs and Tang found that participants used video to express understanding or agreement, enhance verbal descriptions, and express attitudes through posture and facial expression [8]. Similar research found that video was beneficial for non-native speakers and that groups who used both audio and video in a social dilemma game did as well as face-to-face [14].

Temporally distributed teams that experience a time-zone difference of eight hours or greater likely have very different work-life boundary experiences than teams that are two or three time-zones apart [12]. Common means of communicating within highly temporally distributed teams are email, voicemail, and shared repositories. However, none of these media provide teams with the ability to capture visual cues or other information that assists in communicating effectively.

Asynchronous Video Communication Tools

Commercially available asynchronous video communication tools, such as Techsmith's Camtasia Studio and Jive Systems, allow users to send or broadcast individual videos and screencasts to a number of recipients. However, there is limited support to visualize the flow of conversations, and some are complex to use. Our tool specifically focuses on providing lightweight interaction and conversation visualization.

AIR (Accelerated Instant Replay) Conferencing and PAVE (PAL Virtual Environment) are related non-commercial tools. AIR Conferencing allows distributed attendees to catch-up on missed content during a meeting using various modalities – audio, video, shared workspace, and text [9]. PAVE was designed to support asynchronous collaboration among distributed researchers by allowing users to asynchronously replay captured media (audio, text, and drawing) used in a virtual meeting room [1]. Given the cost of using video (in file size) at the time PAVE was developed, it was not included in the tool. Our work revisits this scenario, but with the use of video and screen recording threads, to provide richer interactions.

Thread Metaphor

Frustration from incoherent conversations can contribute to communication challenges in highly temporally distributed teams. Conversational coherence is the semantic meaning gained by the sequence of temporal and topical exchanges among people where the relationship between previous and successive turns is clear and easy to follow and where individual messages contribute to an overall topic [4]. A threaded visualization can help improve coherence and reduce the cognitive load that might otherwise be required to follow along in a conversation.

VIDEOTHREADS

VideoThreads enables team members to capture video, record their screen, and send, receive, and reply to a message. When screen recording, team members can share parts of their screen while simultaneously narrating. Notifications and related metadata of new messages are sent via email with a link to open the message. VideoThreads inherently facilitates many-to-many distributed conversations since many people can receive updates for, and contribute to, a conversation.

The VideoThreads user interface (Fig. 1) is comprised of three windows: the conversation window, the message window, and the screen recording frame. The conversation window displays a hierarchical visual representation showing the flow of one conversation and a list of all conversations along with the properties of each conversation (i.e., the number of messages in the conversation, the date and time of the last update, the people involved in the conversation, and the number of unread messages). A camera icon is shown in the top left corner if the message contains a screen recording. The

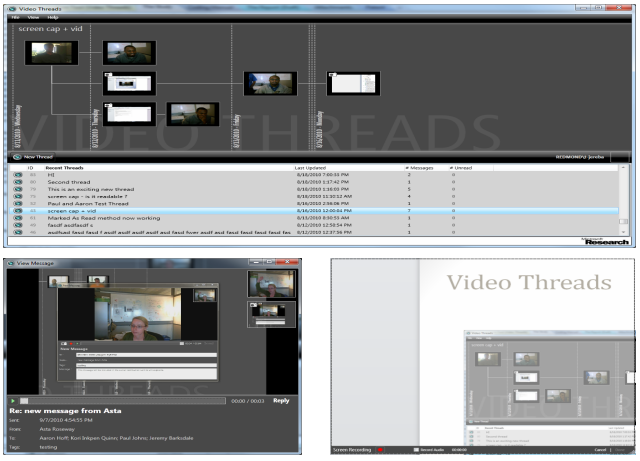

Figure 1: VideoThreads conversation window (top), message window (bottom left), screen recording frame (bottom right).

message window enables users to record a message, preview a recording, or play a received message. The screen recording frame is used to select the area of the screen that will be recorded.

VideoThreads uses a central server that is a repository for videos and the related message, user, and conversation metadata. Videos are stored in the server file system while event log data and metadata are stored in a SQL Server database accessible to client components via a secure asp.net web service layer. The client component is built using Windows Presentation Foundation (WPF) and Microsoft's Expression Encoder library (for video recording and processing). Messages in a thread are rendered according to a hierarchical layout algorithm and their creation date.

TRIAL DEPLOYMENT

We deployed VideoThreads to four teams (totaling 29 participants) over a two week period. Team A (5 members) and D (8 members) were each distributed between Redmond, WA and Shanghai. Team B (8 members) was distributed between Redmond and Zurich. Team C (8 members) was distributed between Redmond and India. Each team had at least one highly temporally distributed member and at least one month of collaboration experience to reduce variability inherent in newly formed teams. Participants used their own computers and received a gratuity for their participation. No guidelines were provided to participants on how or when to use VideoThreads. They decided which communication medium best suited their needs. To better determine when participants would use video instead of email, we prevented users from sending a message without either a video or screen capture in VideoThreads. We surveyed participants on their current communication practices, then deployed VideoThreads, and finally surveyed the participants again to measure any perceived changes. Microsoft Outlook, which allows message threading, was the email tool used for comparison and was the primary email client used by our participants.

Results and Insights

Participants did not collaborate on software development tasks using VideoThreads as expected. Instead, they used the tool for congratulating and becoming familiar with one another. There were 18-56 messages per team (with an average of 38 messages), 11-28 threads created (with an average of 20 threads per team), and the tool was used between 3-9 days (with an average of 7 days). Most threads had 1 or 2 messages; however, others had 3-7 messages. This is consistent with the distribution of email thread lengths reported in [10]. Usage was lower than hoped given the challenge of motivating participants to incorporate the tool into their workflow, although this result is consistent with previous literature on tool adoption [2].

Regarding thread visualization, 55% of participants reported that following the flow of a conversation in email was easy, whereas, 69% reported that following the flow of a conversation in VideoThreads was easy. Additionally, 16% of participants reported moderate or extreme difficulty with following the flow of conversation in email, whereas no moderate or extreme difficulty was reported for VideoThreads. Almost half of our participants, 14/29 (48%), were satisfied with message threading in VideoThreads and no participants were dissatisfied. Fully experiencing the message threading feature requires multiple exchanges on a specific topic. Some participants did not engage in this level of conversation. We believe that one primary reason the remaining participants rated message threading as "neither satisfied nor dissatisfied" is because they did not engage in enough conversation on a topic to evaluate the message threading feature.

In comparison to email, results showed that 15/29 (52%) participants found VideoThreads either more useful or much more useful than email. Other participants seemed to find VideoThreads less useful because they could not edit videos as easily as they could edit email, re-recording videos decreased productivity, it was difficult to quickly seek to a specific point in the video, they could not search the audio or video content, video required more write/read time than email, and most of their close team members were in the same geographical area. For VideoThreads', 20/29 (69%) participants indicated they were satisfied or very satisfied with the visualization component while only 1/29 (3%) indicated that they dissatisfied (Fig 2).

The following four benefits surfaced from a thematic analysis of our qualitative survey data.

Emotional and Personal Feel. One of the key benefits of VideoThreads was that it enabled users to see the personality or emotion of other team members through video. For example, a participant from one team that initiated a thread to congratulate one another for completing a milestone remarked "*it was quite satisfying to see people reacting positively to [the completed milestone], and I could actually see them.*"

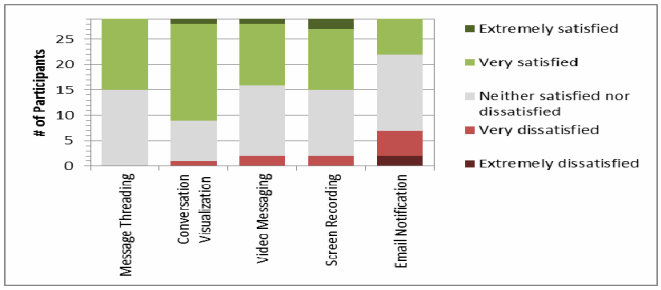

Figure 2: Responses for VideoThreads Features Satisfaction

Participants also reported that they felt more connected with other team members when sharing video asynchronously and that they appreciated the social niceties of video that are less prevalent in email. As one participant explained *"...I grabbed my laptop and just walked around and showed him what the office looked like today, who was doing what, and got everyone to wave and say hi to the camera to try and make him feel more connected.*"

Benefits from being able to see each other on video have been reported in other research [3,8,11]; however, it is important to remember that people on temporally distributed teams rarely see each other, and asynchronous use of video is rare. Some of our participants had never seen some of their teammates and appreciated being able to connect a person's image with their name. One participant commented, "*I haven't met him at all, so it's good to put [a] name to a face and see him actually amusing himself. That always helps.*" Another participant commented that there were elements in the background of his video which he chose to keep visible so that it would communicate some of his personal interests to other members of the team.

Communication Efficiency. Efficiency was seen as both a benefit and a disadvantage of VideoThreads. For example, "*Sending these kinds of announcements verbally… often actually using screen capture, seemed much more efficient to me cause it took less time for me to put together a quick narrated video message of what I was trying to illustrate.*"

However, others missed the efficiencies of email such as the ability to quickly search through and scan across a lot of emails and edit discreet sections of a message. One participant commented that "*with email you can kind of sit, formulate it a little, and type it out, whereas with video [you have to] record and re-record to make sure … you didn't lose your train of thought midstream.*" Others commented on the overhead associated with video, in particular since it isn't a part of everyday work culture: "*Video at this point takes more work. Email - you just start typing. Video, you have to fire up the application, make sure the camera is on, take a look, and sometimes record and [you're] like 'did that sound right?'* "

Value of Video as a Medium. Several participants found value in using video because it helped them explain complicated things such as demoing use of an application, reproducing a bug, or showing a drawing by pointing the

webcam at the whiteboard. As one participant explained: "*I set up a screen capture window [to show] how we should do work item tracking. And so I just pulled up a report that showed what we were making use of. It was easy to show people... and use my mouse to illustrate what pieces of it I was trying to draw attention to.*"

One downside of video was that some people were uncomfortable being seen on video and felt it was too invasive at times. Some also noted the shyness associated with team members who speak English as a second language. As one participant expressed: "*I didn't think this would happen, but trying to take a video capture of myself and sending it to people felt a little unnerving. It's not as simple and straight forward as a voice call or an email.*"

Visualizing Conversations. Conversation visualization was one feature that participants specifically liked in VideoThreads over approaches commonly used in email, *"... the conversation history comes through nicer than in email, so it's easier to see date progression and things like that.*" However, albeit messages were easy to follow within VideoThreads, the overall conversation was sometimes difficult to follow since it was spread across various media, "*you couldn't shift from an existing email thread to add video to that context and say 'well I'd like to add video or screen capture.' And it was hard to do the reverse too.*"

DESIGN RECOMMENDATIONS

From our results we provide three design recommendations.

Integrate with existing communication tools. Not surprisingly, most of our participants wanted VideoThreads integrated into their email tool. They wanted to be able to leverage the address book and email notifications. Also, enhanced thread visualization would allow participants to see all messages related to a conversation, regardless of the media (i.e., email, IM, and phone messages) within the thread visualization. Providing access anytime and anywhere was also important to participants. They wanted more ubiquitous access to the tool—outside the firewall and on mobile devices. Users wanted to be able to quickly scan messages from home or other non-work locations.

Enable Searchability / Editability. The users in our study wanted ways to search videos to find particular content or quickly browse a conversation. Additionally, users wanted more video editing related features to enable them to more creatively compose their video messages and screen shots in personal ways.

Provide Social Aids. Some users found value in the screen capturing and recording feature because it helped them communicate complex ideas more clearly. Some enjoyed the more creative features that allowed them to add virtual artifacts via camera effects to their video message. These features can allow users that are shy and uncomfortable with video a means to communicate more confidently. Translation, transcription, and annotation could assist those users whose primary language is not English communicate more confidently.

CONCLUSIONS

Asynchronous video sharing has its place among temporally distributed work teams when well integrated with existing tools. However, the cost of using video is still high relative to text. Our findings indicate that video can provide opportunities to help teammates gain exposure to each other's personalities and ease complex demonstrations. Team members found fun and interesting ways of incorporating video into their routine to enhance group communication.

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