Demonstrating Timeline: Video Traces for Awareness

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ABSTRACT

Always-on media spaces broadcast video to provide awareness and encourage interaction between collaborators. This video can be captured on the fly as a *video trace* – a visualization allowing viewers to rapidly explore the history of the video stream, ostensibly to gain a better understanding of the activities and availability of their collaborators. In this demonstration, we present a visualization system that allows detailed exploration of a large video stream.

Categories and Subject Descriptors

H.5.1 [**Multimedia Information Systems**]: Video

General Terms

Human Factors.

Keywords

Video media spaces, video history.

1. INTRODUCTION

Always-on video media spaces (VMS) encourage interaction by providing awareness of the presence and activities of colleagues. Once the subject of esoteric research, both the Internet and wide availability of inexpensive web cameras now let people easily create their own media spaces.

The collocated environment provides cues such as arrivals and departures, presence in offices, opening and closing of office doors, and presence of artifacts such as jackets or briefcases that allow us to track the presence and work rhythms of colleagues. In contrast, a VMS provides a limited view, typically a headshot, which viewers may only glance at periodically. Thus it becomes more difficult for viewers to gauge the availability of their colleagues as they are likely to miss important events.

To address this issue we created a system called Timeline which captures the video stream broadcast in a VMS and presents it as a visualization allowing users to easily and rapidly explore the history of the video stream. The demonstration illustrates Timeline in action.

2. RELATED WORK

Gutwin [3] suggested the idea of *traces* – visualizations of the recent past – as a way to help groupware users increase their understanding of each other's actions. While his paper applied the idea to telepointer tracking, Gutwin also suggested that traces might be used with video to allow for casual awareness. In a similar vein, the 'When Did Keith Leave?' system by Hudson and Smith [4] selects and displays several frames from a video stream that show significant visual difference. Their focus was on demonstrating how privacy issues might arise as a tradeoff of providing awareness information: while collaborators can benefit by using the system to see each others recent activities and events, it also serves as a (perhaps unintended) surveillance system.

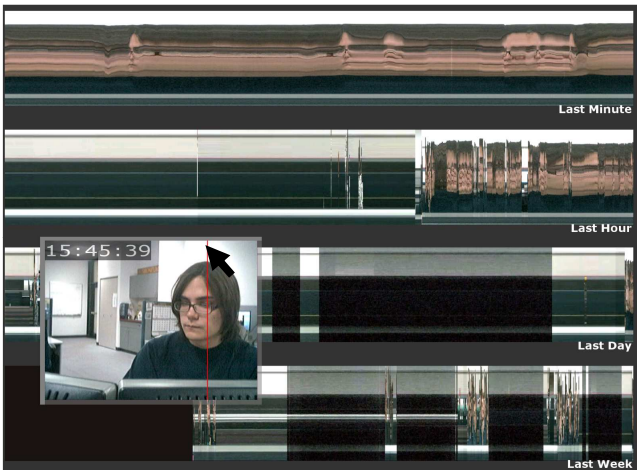

Figure 1. An example of the Timeline showing the video history of a personal workspace over several days.

In Timeline, we use the idea of the *video slices* technique [2, 5], to show the passage of time in a video stream. A video slice is created by sampling a single pixel column from successive video frames. By abutting these columns we see a cross-section visualizing the video stream over time. Video Streamer [2], for example, used video slices to create a 3D block for rapid video editing. Artifacts of the Presence Era, by Viegas et al. [5], was an art installation system that provided a temporal visualization of a video stream of people visiting a museum using a layered rock formation metaphor. Layers were added to the visualization by periodically taking slices from video frames. Visitors could navigate and uncover past images by turning a knob. Similarly, the Last Clock by Angesleva and Cooper [1] used video slices to populate the face of a clock. As the hands moved around the clock the current (rotated) video slice replaced the underlying portion of the clock face.

These video visualization projects were mostly focused on visualizing the passage of time. Our own interest took this one step further: how collaborators could find and understand the

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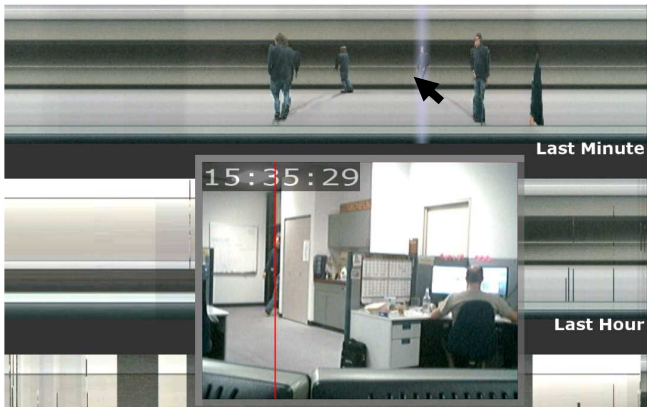

Figure 2. The visualization is focused on the distant door. The video is quickly replayed by scrubbing over the visualization.

detailed activities and events occurring within a large video stream.

3. TIMELINE

Timeline replicates and extends ideas presented in systems such as the Last Clock [1], and Artifacts of the Presence Era [5]. It too uses video slices to create composite images, and forms a timepiece, similar to the Last Clock [1], using multiple rows showing the last minute, hour, day, and week of video. Figure 1 illustrates the Timeline visualization after running for several days. The contiguous video slices in each row give observers a sense of the video history, where changes an perturbations are easily seen. The current video image is displayed in the floating video window.

One way in which Timeline extends on previous systems is by allowing viewers to adjust the focus area. The red line in the video indicates the column from which the video slices are taken. Viewers can interactively update the visualization focus to a different area by moving this line over a new column in the video frame. As the line is adjusted, the entire visualization is updated immediately.

Another significant improvement on previous systems is that Timeline allows for very rapid and detailed exploration of the video history. Clicking and moving scrubs over any of the visualization lines, where the user can rapidly replay and view the images from the video history underneath. This is illustrated in Figure 2 where the viewer has selected a region of the minute line (as indicated by the translucent band) over a perturbation. The video window reveals that it was someone just entering the room.

Quickly scrubbing over one of the visualization lines allows the viewer to replay the video at a very high speed. However the granularity of the playback detail in the day and week lines is much coarser than in the minute and hour lines as more time elapses between selectable frames. To fix this, Timeline provides detailed exploration of the distant past by allowing one to select an area in one of the coarser grained lines for further exploration. Timeline then retrieves the detailed video and freezes the finer grained visualizations to show how they were at the selected point in time. This is illustrated in Figure 3 where a point has been selected in the day line and is being displayed in the hour line as indicated by the green braces between these lines. The search has been refined further by selecting a point in the frozen hour line to be displayed in the minute line.

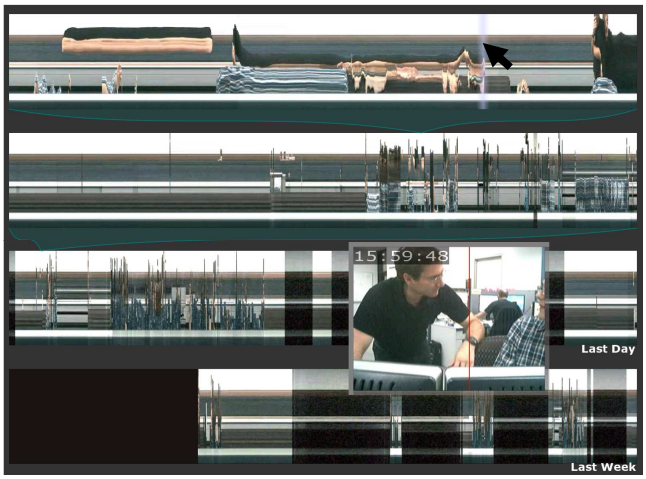

Figure 3. Regions in coarser grained lines can be selected for detailed exploration in the finer grained lines.

While the images produced by the visualization may appear to be difficult to understand at first, viewers quickly learn to read its perturbations. For example Figure 1 shows the Timeline focused on a person at their desk. In the minute line the perturbations and partial scans of their face indicate their presence, while the hour line shows that they have been there for about 20 minutes. The day and week lines give a broader overview, showing night and day and giving a sense of the activity over the last few days. As another example Figure 2 shows the Timeline with the focus column set on the distant doorway. As people enter and exit the room, the visualization in the minute line shows their recognizable scanned image as they cross the boundary, while the hour line shows this change as a single column perturbation.

The Timeline system is exceptionally powerful in its ability to allow viewers to explore a large history of video data. However, it is this power that could make it a very invasive system. Potentially embarrassing or inappropriate behavior is not only captured, but easily found and replayed. Because of this it is difficult to predict where it might best be used and the cultural practices that would be created around it. Perhaps it would be suited to areas that are largely accepted as public rather than private offices and workspaces. Or perhaps it would work well between tight teams or social intimates with a strong desire to stay connected. Or perhaps CSCW is the wrong venue; it may better serve as a system for security and surveillance.

4. REFERENCES

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