Implementation of Back Channel using Visual Interface

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Abstract—*Micro blogging communities like 'twitter' are being used heavily by the people in now a days to share their views on globally happening issues. Blogs like 'twitter' are being used only as digital back channels where information will be displayed in the form of lists only. From digital back channel, people have to distract from their current conversation in order to know the information regarding other conversations happening around. Also digital back channels are lacked in the ability of displaying past history of current conversation. On the other hand, we propose visual back channel which provides interactive visual overview of ongoing conversations on a back channel. To incorporate visualization for continuously updating information, we include current conversation and its past history as well. As part of fully web based coordinated system, we introduce topic streams; a stacked graph visualizes topics over time, people spiral-representing participants and image cloud- describing the degree of sharability of images by their size.*

Keywords—*digital back channel, micro blogging communities, topic streams, ,information retrieval, post listing, people spiral, image cloud.*

I. INTRODUCTION

These days, as people are really interested to share their timely pieces of information regarding international ongoing happenings; they are attracted to use digital back channels, which create persistent conversations about events of social significance. Digital backchannels have become an exciting communication medium, over which more and more people exchange impressions, suggestions, and comments during events. Such backchannels not only enable participants to share their experience and shape how observers recognize an event, they are also used to help participants to describe an event and its outcome.

We can observe certain drawbacks with existing methods of displaying information in current digital back channel system, the chronologically ordered lists themselves are not sufficient for large-scale backchannels as they are unable to represent enough information in real-time conversation scenarios. This may affect those participants to get distracted from the main event, and lack an overview of what the backchannel contains [1, 2].

To explore these issues, we introduce Visual Backchannel, an interactive and versatile interface that integrates three visualizations with a list of backchannel posts. In order to give new perspectives on backchannel conversations, we introduce *Topic Streams [4]*, a temporally and topically adjustable stacked graph that visualizes topics extracted from digital backchannel conversations. This is accompanied by two compact visualizations, *People Spiral[4]* and an *Image Cloud[4]*, presenting visual aggregates of active participants and shared images.

This way Visual Backchannel provides visual evidence of what is happening now, and what is recent within the ongoing temporal context of how backchannel conversations spread out over time. We provide representations of a constantly changing data set, and interactive access to the temporal distribution of topics, the most active participants, and salient photographic impressions.

With this work, we introduce three novel interactive visualizations that summarize the main facets of large-scale backchannels and provide exploratory interactivity along time, topics, and people in the context of a Visual Backchannel interface.

II. RELATED WORK

Our work can be situated in the context of visualizing persistent conversations, experiencing digital backchannels during a wide range of events, and representing topics over time.

A. Visualization of constant Conversations

Previous research on visualization of human communication considered mostly its social and expressive aspects only. Email exchanges can be visualized as thread arcs representing reply structure and temporal order. We are interested in providing overviews of the main topics being discussed.

In contrast to social and structural aspects of conversations, little visualizations attempted to represent the actual topics being discussed. Conversation Map displays participants, salient topics [3]. The mail visualizes how topics in personal email conversations develop over time using stacked lists of keywords arranged along a horizontal time axis [5]. Both Conversation Map and The mail provide content-based perspectives on conversations; however, they have only been applied to archives after the fact, not to real-time conversations as they open up. While the former summarizes who is and has been

talking for how long, the actual content and topics of the conversation are not represented. The latter cluster visualization lacks the history visualization that the earlier technique incorporates. We extend this research that emphasized primarily social and structural aspects of discussions in that we focus to represent conversation topics in the context of their temporal development together with participant's activity and pictorial impressions.

While previous work represented either small, live conversations or large, archived discussions, our work explores the case of large-scale real-time conversations.

B. Visualization of topics as They Change

In the following, we discuss visualization research that considers the temporal, topical, and social character of shared information. The most relevant earlier work is ThemeRiver, which visualizes user-selected themes of news stories as horizontally-centered stacked graphs.

A recent revisit of the ThemeRiver approach adapted it to entertainment datasets and suggested new methods for ordering and coloring the streams .

The main limitations of these stacked graph techniques are the fixed length of time frames, the static selection of themes being used, and the lack of zooming or filtering operations. In our work we are introducing a stacked graph technique that is temporally, topically, and socially dynamic by visualizing live changing data and allowing temporal zooming and interactive filtering along topics, people, and search terms. For existing visualization techniques, earlier work explores the idea of live-updating views by encoding data changes as animations, In another example, For an election, people were asked to share their feelings as individual words resulting in a sentiment visualization representing the most salient emotional adjectives differentiated by party affiliation. These and many other examples of web-based visualizations can be framed as a visualization practice ranging from personal reflection to social awareness [9].

To our knowledge, there has been no work on evolving views combining both current and past changes of topics over time. With our work we want to integrate current, recent, and past topic changes using visual and interactive representations.

III.   DESIGN GOALS FOR VISUAL BACK CHANNEL

When considering large-scale backchannel conversations, participants will have to switch between the main event and the backchannel. So we attempt to represent the "now" in the context of the "recent". By aligning the visual variables for current activity with the representations for recent developments, we attempt to help participants in recreating awareness.

In particular, we want to help participants to answer common questions quickly about an ongoing backchannel conversation, for example: What are the main topics right now? How are topics changing over time? Who are the most active participants? What are certain participants talking about? Based on these questions, previous research, and our own experiences with events and backchannels, we derived the following design goals for a Visual Backchannel interface:

A.   Conversation Summary

A Visual Backchannel should include views that summarize the topical, social, and pictorial aspects of backchannel conversations so that cognitive analysis required to follow a backchannel may be decreased. The main topics, most active participants, and most popular images of a conversation should be visualized indicating both activity and development.

B.   Integrate the 'now' and the 'recent'

Visualizations should capture backchannel conversation at the current moment and in the context of its recent development. This way participants should be helped in making sense of current activity by being able to review recent developments. For example, when briefly switching attention away from the event towards the backchannel, it should require little effort to recover awareness and focus.

C.   Extend presence of the present

As the 'now' really does not take any time, there should be visual stress for current activity such as incoming posts and subsequent changes in the visualizations. This way current backchannel activity should become more comprehensible.

D.   Provide flexible time windows

Considering that events may last from minutes to several weeks, the interface should provide flexible methods for modifying the time window under exploration. The temporal selection should influence the extent of visual change in the interface. With narrower time spans, more visual activity is expected.

E.   Allow for topical and social exploration

Besides time, the main dimensions for interactive exploration should be the topics and the participants of the backchannel. Selecting individual participants should indicate their pattern of topical development over time. Selecting topics should reveal their most active authors and co-occurring topics.

IV.   DESIGNING A VISUAL BACKCHANNEL

In this section, we design a Visual Backchannel as a coordinated-view interface which provides interactive and visual access to the current activity and ongoing development of backchannel conversations. Besides displaying a conventional list of backchannel posts, the Visual Backchannel interface consists of three novel visualizations named by *Topic Streams*, a stacked graph visualization of conversation topics, which uses most of the screen and below to it, *People Spiral*, a helical view of the most active participants, and an *Image Cloud* featuring photographs taken during an event .While designing artistic aggregations that summarize topical, social, and pictorial aspects of a backchannel over a given time period, these visualizations also highlight current activity in ongoing backchannels.

The visualizations provide ways for interactive and responsive cross-filtering along time, topics, and participants. Furthermore, the interface features interactive representations of currently set filters, including text search, and a conventional list of backchannel posts giving rapid access to the data being visualized.

A. Topic Streams

The primary view of our Visual Backchannel is used by Topic Streams, an interactive stacked graph that visualizes live-changing textual data across time and supports interactive exploration by temporal zooming and panning, and topical filtering. In contrast to previous stacked graph techniques that relied on fixed time intervals and predefined categories, such as news topics [6], movie titles, and artist names , our Topic Streams support multiple levels of temporal zoom and are based on the changing textual contents of tweets.

- *Representing Conversation*

Development: We choose a stacked graph as the main visualization, as we can use it to represent both current and collective changes in the backchannel conversation. The visualization uses an integrated set of visual variables and arrangements to represent topical development:

Position : Time dimension will be represented along the x-axis of the visualization Depending on the time window, we have date and/or time labels on the top. At the far right edge of the view, 'the present' is positioned unless the viewer changes the temporal selection to a past time window. Similar to previous stacked graph techniques, the y-axis is used to encode relative frequency of topics by the vertical width of the stream corresponding to a topic at a particular time point.

In order to reduce drawing complexity and ensure interactive responsiveness,we display the 30 most popular topics and omit less popular topics,. However, less popular topics can be explored by filtering by participant or text search.

Ordering:

One of the ideas is to arrange arriving streams on the outside (both top and bottom) and streams that have arrived earlier close to the inside of the stacked graph. We decided to order by newness of a topic from top to bottom of the streams. The choice of newness as an ordering measure over time of first occurrence is based on the observation that the first occurrence of a word in an individual tweet alone does not make it a conversation topic, but only when it is picked up by multiple participants.

As we have taken the current time window as the basis for topic selection, we calculate a newness measure by averaging the timestamp of all those topic occurrences from the beginning of the event until the end of the current time window. This way newness represents the novelty of a topic within a particular time window of an event defined by the current temporal selection. Similar to the typical ordering of blog and Twitter posts, we order the topics by putting the newest topics on top.

- *Interactivity*

The Topic Streams support three basic filter interactions: temporal zoom, temporal sliding, and topical selection. All these interactions result in animated transitions of the Topic Streams reducing the cognitive cost of following the change.

Temporal zooming: The zoom level specifies the basic unit for each time interval. A range between ten seconds and a month per interval, with seven steps in between, was chosen to represent a wide spectrum of events and allowing viewers to set their time span of their choice. The viewer can change the level of temporal zoom by scrolling with the mouse wheel, similar to how zooming works in web-based mapping services, or clicking on the corresponding button above the Topic Streams. This zoom event is acknowledged by an animation of the grid representing the time intervals. As soon as the data for the new time window of the topic visualization has been transmitted to the browser, the Topic Streams are updated through animated transitions.

Temporal sliding: The viewer can also change the current time window by sliding it to an earlier or later period. Also similar to web based mapping tools, the viewer can simply drag the topic view either to the left or to the right or select corresponding buttons to move the time window to a later or earlier time point. By dragging with the mouse pointer, the streams, time grid, and time labels will follow its movement, and after releasing the mouse button they will snap into the chosen place. When the viewer drags the topic visualizations, there will be pre-rendered parts of the streams with the length of the current time window in each direction.

Topical selection: Besides changing the temporal granularity or position of the Topic Streams, the viewer can also change their topical composition by selecting a topic itself as a filter. This has the effect that only those Topic Streams that coincide with the selected topic will be shown. The selected topic will be removed from the Topic Streams, as it is implicitly present in all selected tweets and thus will not change the visual representation of the Topic Streams. Instead the topic filter will be represented as an interactive button above the topic visualization
that allows its cancellation by simply clicking it.

B. Compact Visualizations for Participants and Photos

Besides the rich and sophisticated visualization provided by the Topic Streams, we decided to choose more compact views representing the people participating in a backchannel and the shared photos. Together these views can only use about one third of the screen area of the Backchannel interface to have sufficient screen space for the post listing particularly guided by the goals of designing for an organic appearance and making efficient use of the screen space, we came up with two visual, yet compact, views that summarize the activity of backchannel participants and their pictorial impressions.

- *People spiral*

In order to represent participants contributing novel information to the backchannel in visual way, we designed the People Spiral layout consisting of dots and labels representing backchannel participants and their activity (see Figure 1).Each dot in the spiral stands for a participant using the dot size to represent their activity in the backchannel, based on the relative number of tweets within the current time window and topic selection. The color of a dot indicates the originality of the person's posts. The more tweets were quotes, or re-tweets, the less saturated the dot is. The base color is a tone of blue. in richer and more intensive colors than those mostly re-posting.
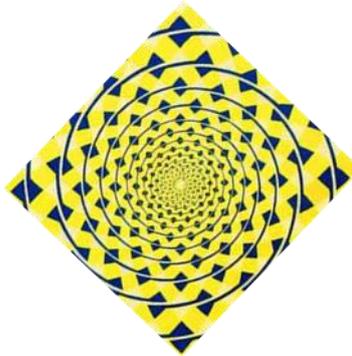
*Figure 1.*people spiral

Another goal for the design of the People Spiral is to visually represent as many people as possible, and give precedence to more active participants. An early design included an icon list of participants, which did not indicate activity and could only display few people without having to scroll. We chose a spiral layout for its organic shape and the ability to represent many participants in a compact area. The People Spiral is ordered by activity and represents up to 300 participants. The most active participant is positioned at the outer end of the spiral on the right side with its label straight and easily readable.

Depending on the current temporal and topical selection, the number of participants displayed varies. In order to represent large numbers of participants, we omit the labels for less active participants whose dots are positioned in the inside of the spiral. If the number of participants is below a certain threshold, currently set to 40, the layout reverts to a full circle displaying the labels for all represented participants (see Figure 1, bottom right).

The labels allow interactive filtering by participants. Selecting one will change the color of the label and dot to orange and add a participant filter on the top right of the interface. Clicking again on the label or on the filter button will withdraw the filter. Selecting another participant will change the filter. In combination with other views, filtering by participant allows us to quickly see what individual people have been talking about in the backchannel. We have experimented with selecting only the posts by the selected participant and also including those that mention them. We find both cases to be useful.

- *Image Cloud*

The Image Cloud is a Lightweight view for socially shared images, inspired by the widespread use of tag clouds on the Web . Similar to how tag clouds typically use font size to encode how often a tag has been associated with resources in web communities, we can adjust the area an image uses in the visual display to indicate how often it has been shared in relation to other displayed images. As posts on Twitter can contain links to images, it can be observed that images and, in the context of events, photos assume social significance based on the re postings by participants.

With the Image Cloud, we connect these social frequency measures by displaying more frequently posted images larger than those that have been posted only once (see Figure 5).In our current design, we focused on the presentation of at

most 70 image thumbnails with a square aspect ratio, however, this technique can be easily extended to arbitrary rectangles and larger displays.

The positioning of images is based on an iterative force-directed layout algorithm that is seeded by initial positions with larger images positioned closer to the centre and smaller ones further at the periphery of the view. In order to make efficient use of the space devoted to the Image Cloud we need to adjust the maximum image size on the basis of the image frequencies and quantity.

In our prototype, we set the maximum length of image thumbnails using the following formula:

$$l_{max} = \sqrt{A/(S \sum_{I=1}^{M} Pi/Pmax)}$$

with *A* for the screen area, *M* for number of images, *Pi* for occurrences of a particular image, P*max* for maximum occurrences among all images, and S as a spacing constant ranging between 1 and 2.5.Depending on artistic intentions for creating customized backchannel displays, one could, for example, decrease *s* creating larger overlaps and images. Exploring these artistic considerations a little further, we have experimented with adding small, random rotations to images around the z-axis as a simple way of creating a more 'natural' appeal similar to the visual of photo collages. By setting the range of rotation *r* and adjusting the spacing constant *s*, one gets a spectrum of visual layouts for an Image Cloud that ranges between a clean mosaic-like layout and a messy collage view with many overlaps.

$s=2.0\, r=0^{0}$ $s=1.5\ r=25^{0}$

Fig. 2. Different visual arrangements for an Image Cloud representing 70 photos shared during the SXSW 207 festival on Twitter. Layouts differ by margins between images, adjusted by the spacing constant *s*, and the image orientations, specified by the rotations range *r*.

A relatively high spacing constant leads to open unused areas in the layout and relatively small images (see Figure 2, left). Reducing the spacing and adding rotation both increased the area used by shared images and also added an interesting visual pattern (right). The spacing and rotation constants provide the designer of a backchannel interface with more control over its visual appearance. While image spacing and rotation for visual purposes may appear like visual clutter, we think that an appropriate balance between order and deviation in the layout can make the presentation both appealing and useful.

V.   CONCLUSION

We have designed the Visual Backchannel, a novel medium for exploring large-scale conversations around events, making it possible to get a visual view of backchannel conversations over time and to explore its temporal, topical, social, and pictorial facets of live continually changing data

In order to visually summarize what a backchannel conversation is about and how it changes, we have introduced Topic Streams, as temporally adjustable stacked graphs, and two lightweight visualizations, People Spiral and Image Cloud that represent the participants and images of a backchannel.

These three visualizations provide the participant to engage in different types of interactive explorations to focus on the subset of a backchannel conversation by selecting a time span, participant, and/or topic of interest .The current moment or 'the now' is caught up in what is actively taking place in the posts. However, to understand the topics in the now, one needs the context of the immediately preceding, or 'the recent'. Further, both the now and the recent need the context of the on-going but slightly longer term focus of the event.

We see this research in a larger context of exploring emerging social information streams that have considerable value for both observers and participants of backchannels. While we have addressed challenges of data change and development in the context of backchannels for events, we feel that there is a need for much more research on representing both the 'now' and 'recent' in changing information spaces.

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