Visualizing Lifelog Data for Different Interaction Platforms

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Abstract
Today we are witnessing diverse forms and styles of interactive platforms and devices quickly penetrating to people's everyday lives. New applications and services for smartphones, tablets, game consoles connected to TVs, and other embedded appliances are constantly appearing and diversifying the way we interact with technology. Thus when we design visualization and interaction strategies for the emerging *lifelogging* activity, it is important to consider affordances and contexts for these emerging interactive devices: by the time the lifelogging activity becomes truly ubiquitous, we will be interacting with even more diverse set of devices to support the activity. In this paper, we describe an early stage of our on-going project where we sketched a series of interactive visualization and their corresponding usage scenarios for three different interactive platforms: (1) smartphone, (2) tablet, and (3) desktop. Our sketch was rendered on these corresponding devices in such a way as to maximize the special interaction characteristics of each device and provides three very different lifelog data usage scenarios.

Author Keywords
Visual lifelog; Information visualization; Human computer interaction

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Influenced by Quantified Self movement[1], more people are interested in tracking personally relevant data throughout daily activities, from locations, photos, email correspondences to biometric data, moods, sleeping patterns, and so on. The creation of multimodal digital archives, or *lifelogs*, is becoming commonplace. These lifelogs offer great potential in providing valuable information about ourselves, which can be further investigated to infer insights into our own lives [1]. The scenarios and potential benefits for constructing and visualizing lifelogs are compelling.

On the other hand, the platforms and devices from which we could interact, explore and gain insights on our own lifelogs are quickly diversifying: smartphones, tablets, game consoles connected to home TV screens, large public display walls and many other embedded appliances at work and home are promising very different ways to view and make sense of our lifelogs. Thus it is curial to consider the affordance of these diverse devices as our expected interactivity platforms during the design process for lifelogs.

Existing studies have found that [2], among the variety of lifelogging contents, photo is most often the main focus and interest to users. Images provide rich resource for reviewing individual's everyday life experiences. However, we cannot merely apply traditional visualization techniques on visual lifelogs, as simple image lifelogs do not generate improvement on users' memory recall in long term [3]. We argue that effective interface design should consider the unique characteristics of visual lifelog data, and should be tailored for different interaction platforms in order to maximize the usage context. We combine the following premises into our design work for lifelogs: i) supporting reminiscence and reflection should be addressed, as users do not just want to recall purely factual events; ii) visualization should reflect underlying characteristics of visual lifelog content; iii) designing the visualization should be according to the affordances and characteristics of the platform in concern, and iv) The level of detail at which information is presented to users should be determined during design process.

In the following section, we identify main characteristics of visual lifelog by comparing it with personal digital photo collection. Based on research findings, we then present our visualization design process and the visualization sketches as outcomes. We illustrate three novel approaches towards three types of different platforms, i.e. smartphone, tablet, and desktop. We conclude with design findings and make suggestions for future avenues of research on lifelog data visualization.

Characteristic of Lifelog Data

A variety of popular sensing devices have been created and are available today, offering the possibilities of lifelogging conveniently and effortlessly. For example, Memoto[2] is a tiny camera that allows users to clip on and wear. It automatically takes photos in situ. Visual lifelogs share many of the properties of regular

[1] Quantified Self: Self Knowledge through Numbers.

[2] Memoto Lifelogging Camera. http://memoto.com/

personal digital photo collection. Thus, by examining the differences between the two will inevitably lead to better insights on finding design implications for effective interactive lifelog visualizations.

Passive Capture
The most distinction worth noticing is that lifelogging device *passively* capturing subject's life, i.e., non-obtrusive to the lifelogger. The device is normally oriented towards the activity the user is engaged with, which provides a perspective nearly same as when it is experienced. On the contrary, for a regular personal photo collection, the user needs to intentionally capture photos when the moment is decided to be useful, by disrupting his or her current activity.

Continuity
Due to continuous capturing ordinary day-to-day encounters, sometimes, mundane photos are generated in a lifelogging activity. One the other hand, many precious moments are also captured that otherwise would be missed by regular photo collections. People selectively choose special life events to capture, such as vacation, wedding, birthday, etc. [4] In terms of the importance of lifelogs, single photo might not be as meaningful as intentionally captured photos. However, a group of photos as captured during a particular event as a whole can contain the level of details unable to capture in a well-taken regular photo and generate more immersive re-living or storytelling functions.

Rich Contextual Cues
Lifelogging device chronicles a user's day into visual archive of photos along with its associated sensor data logs. Available sensors employed on lifelogging devices include accelerometer, GPS, Bluetooth, WiFi, ambient light sensor, microphone, and so on. These sensors collect rich contextual details of a person's daily life, serving as the cues to support information to display. As regards to regular personal photo collections, typically contextual data available is only time and location. Thus, exploiting this rich context data is one of the key differences.

More Variety of Usage Scenarios
Personal photo collection mainly serves reminiscence and sharing function to users. Visual lifelog can serve more variety of purposes as being explored and researched today. Sellen and Whittaker defined functions of memory that lifelogs could potentially support referred to as 5Rs [5]: recollecting, reminiscence, remembering, reflecting and retrieving.

Large
Sensing devices automatically capture thousands of photos, and typically about ten times more of sensor readings per day than a regular photo-capture practice. Such expanded recourses make it very difficult to access and retrieval. Aggregation of raw data into different semantic contexts, allows the presentation to be meaningful to users.

These characteristics above provide us with a set of implications for future lifelog visualization design. The user interface should preserve the temporal nature of lifelog archive. It is important to group data into meaningful segments, then select summary information to represent these segmentations. Contextual cues can also be utilized to help in better interpreting the data. Through multiple interaction modalities for different devices, we are able to reconstruct lifelogger's past life experience efficiently.

Figure 1. Smartphone overview.

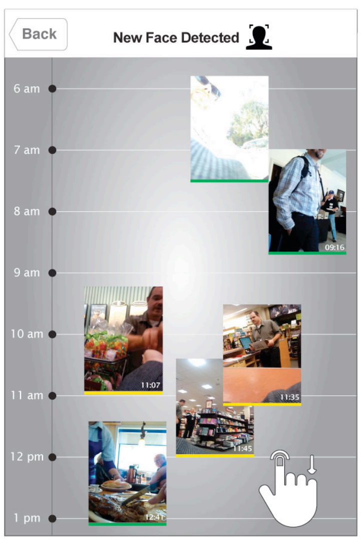

Figure 2. Detailed view interface for smartphones.

Overall Design Concepts and Process

Data gathered by lifelogging devices should be processed first. Additional analysis on the content can be applied to enrich the data into more meaningful "life streams". By grouping sequences of related photos into "event" segments [6], we can reduce visual complexity. We identify important segments by employing a series of image processing technologies. By aggregating the time-stamped sensor log, annotations that describe these events are generated [7].

One simple but very effective design guideline for the data representation and interaction followed for our work is Shneiderman's information seeking mantra [8]: overviews first, zoom and filter, then details on demand. Now we describe our sketches for three different interaction devices.

Lifelog Interaction for Mobile

People usually use their mobile phones under busy disruptive environment, such as in a subway train. The limited display size makes it important to prevent information overload or lengthy interaction sequences. The implication of these is that full utilization of the back-end processing and algorithms should be done in order to condense or summarize the data as much as possible and minimize the user's cognitive burden.

In order to better utilize the limited screen space, compact view of the visual lifelog is displayed to fit full screen. On this interface (see Figure 1), the user overview summarizes of the day/week/month/year through photos selected ('most appeared face', 'most social active moment', 'most important shot', 'new face detected') by preprocessed algorithms. Each photo is color-encoded, indicating the physical activity associated when the photo was captured. Number of unique events, and number of unique faces detected is also displayed, with comparison to previous data.

Users tap on other views (day/week/month/year) to see lifelog data over a different timespan. By tapping over interested grid. A list of similar photos will be displayed on a timeline for further exploration. For example, in Figure 2, all the photo contains new faces are displayed on screen, with x-axis indicating the photo's importance score, y-axis indicating time sequence. By shaking the mobile phone, the interface will ‘shuffled’ with an alternative selection of photos.

Lifelog Interaction for Tablet

Tablets are more often used in a lean-back, leisurely environment such as sitting on a coach at home. Under such a context, we see more suitable usage scenario being reminiscence and reflection. Furthermore, with finger-touch interaction and relatively large screen size affords a more direct and simple interaction yet graphics-rich visualization.

In our design (see Figure 3), the screen is divided into two main sections. Bottom half summarizes the day by displaying a set of representative photos. X-axis represents time while Y-axis is for event importance score. The higher the position, the more important the event is. Upper half is for displaying all photos contained in selected event. At the upper-right corner, a sparkline indicates the social activity level. At the bottom of screen, timeline chart indicates the lasting period of each event. Color-coded photo border indicates the types of activities the user has performed, mapping the physical activities to visualization in an intuitive way.

If the user is interested in a specific event segment and would like to see more information, he can relive past experience by flipping through the photos from carousel panel. A short text description is generated for each photo automatically, which acts as memory for better user experience.

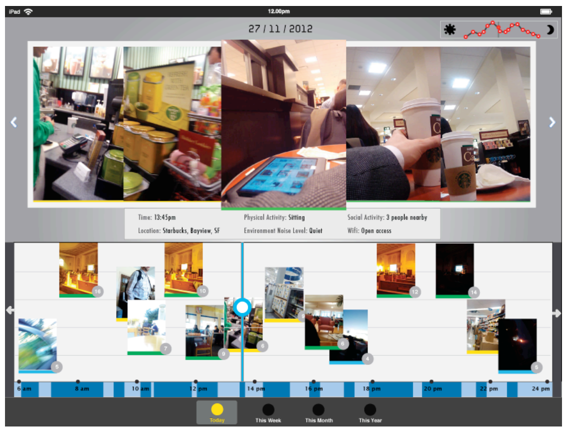

Figure 3: Divided sections with finger-interaction for tablets.

Lifelog Interaction for Desktop PC

Screen size of PC can be quite large, and people use it for tasks that need focused attention. Rich visualization can be easily applied to help observe patterns, motivate people in reflection on their life activities; fine-grained control of a mouse-cursor means relying on frequent interactivity for encouraging data space exploration is desirable.

Based on calculation of importance score for lifelog events, the interface we designed (see Figure 4) generates a symbolic pattern. Each line represent one day of visual lifelog content. It allows users to gain high-level overview of daily activities, and provide a good point of access for more detailed information on demand. This visualization contains multivariate content: 1) Event: each circle is an event segment. Size of circle shows its importance score, figure indicates the number of photos contained; 2) Social Activity: stepped lines depict user's social activity level throughout the day. Embedded sensor logs are utilized to identify social context; 3) Physical Activity: color-coded timeline provides visual cues for the types of physical activities.

By dragging the timeline play header, a fan of photos is triggered around the highlighted event. User can filter the information on screen by adjusting the activities/time/face/event slider bars. By comparing the activities happened around same time across different days, it is possible to detect users' life patterns. For example, Figure 4 reflects important events and social activities happened between 9am-5pm Mon-Friday.

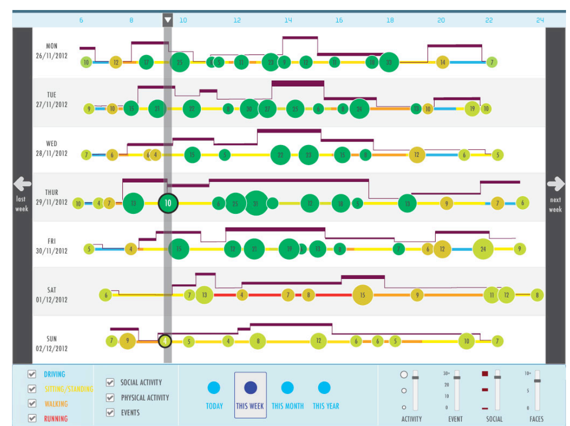

Figure 4: More elaborate visualization with desktop PCs.

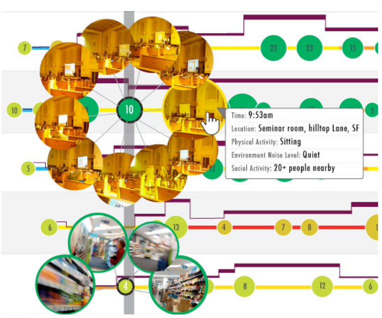

Figure 5. Fan of photos displayed around highlighted event segment.

Future Work

Soon we will be investigating more novel usage scenarios and visualizations for other types of interaction platforms and combining various modalities such as voice, haptic, sound, gesture, augmented reality, and so on. For example, some combinations of these will allow a visualization that can stand in the background of the environment that will not require users' full attention, but can be perceived half-unconsciously while they engage in their other activities.

We plan to deploy interface on users' devices to understand their daily interaction with the visualization over time, conduct user evaluation, and ultimately find answers to these fundamental questions: What is the best way from an HCI perspective for visualizing lifelog archives? How should we adapt interfaces, so that they can support people in different environment?

Conclusion

Personal lifelogs contain information that plays an important role in reflection on oneself. Through visualization, we offer dynamic overview, and interactive navigation with data that may otherwise be difficult to see in other forms. The main contribution of this paper is to find underlying characteristics of visual life logs, and use them as design implications to come up with various interactive visualization strategies for different types of devices. We hope to evoke discussion on the best ways from human-computer interaction perspective for designing lifelog visualizations.

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