

# An Approach to Photo Album Visualization as a Collection of Memories and Experiences

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## Abstract

In most cases photography is considered to be a medium to save and share memories and emotions from photographed events. We have proposed an innovative method of photo album visualization, which is used for events recall, recognition and for navigation through a photo album. Thus we can easily satisfy the needs of most photographers. Visualization described in this paper is also intended to enhance positive user experience while browsing photo albums.

## Categories and Subject Descriptors

H.3.3 [Information Search and Retrieval]; H.5.2 [User Interfaces]: Graphical user interfaces (GUI)

## Keywords

User experience, Interaction design, Multimedia

## 1. Introduction

Digital photography has existed for nearly 20 years (since 1991). About ten years later the first mobile phone with an integrated camera was manufactured and nowadays more than 90

Character of the mobile photography or a way how the Facebook users share their photos proves that for most people a photo gallery is a way how to present experiences

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from their holidays, trips and events. In most cases, taking pictures is a process of saving memories via a camera and therefore the visualization of photo albums should communicate these memories to make events unforgettable [1, 2]. Thus it is important to create visualization providing global overview of experienced events, which helps users to

- *recall memories* - for those who were attending the events,
- *recognize memories* - for those who were not attending the events.

As times go by, the recall is becoming the recognition because users are forgetting their memories. This is the reason why the recognition is also important for those who were attending the events. The next aspect of presenting memories which we are focusing on is user experience. Presentation of experienced memories is mostly about evoking similar emotions, which users feel during the events photographing. According to this it is important to create positive user experience via interaction model as a complement of the memories recall.

Our proposed method is based on an experiment. People were asked to tell their stories as they do when they share their memories from various events. We have found out that the most important part of the storytelling was identification of the most interesting events following by connecting these events together. Connections between events were mostly based on chronological order. Thus there is a need to create visualization which supports both pinpointing most important events and visualizing chronologically order of the events. The survey shows that by this way it is more or less possible to reproduce the storytelling.

## 2. Related Works

During the 20 years of digital photography existence no bigger change was made in photo album visualization. Most of existing solutions are focused on presenting photo albums in a manner of presenting photographs in a sequence one by one without any global events overview. There are widely used commercial solutions like Flickr or Windows Live Photo Gallery which provide functionality like photo clustering into events, but there is a missing visual connection between events.

There are also some interesting research studies. The most similar to our goals is the solution described in [6]. Toyama et al. analyze many aspects of photography. They use mostly photography metadata to provide user with exhausting information presentation. The main application window is split to seven parts and each part presents an aspect of a given photography and a photo album as a whole. The emphasis lays on a map-photo connection. However, this solution presents many views of a photograph and photo album but we consider it too complex for casual not computer-skilled users.

In [3], Fujita et al. created photo collection presentation mostly focused on storytelling on a map. Arrows are drawn on the map to picture spatial information of a photograph and direction of camera when the picture was taken. The presentation is also supported by photograph slideshow which shows users the chronological order of photographs. This solution is meant to present virtual street tours and thus it is too specific for general use.

In [1], Ames et al. bring an idea of multi-stories visualization called PhotoArcs. The visualization is based on arcs which stand for stories of users. The arcs are placed on a 2D plane and are covered by photos. The photos on the plane are positioned into clusters and the clusters are commented as a whole which slightly outlines story events. The intersections of the arcs are identified as intersections of stories. The main contribution of the presentation is in collaboration between users. The photograph presentations are created collaboratively as a social activity. We consider this idea very interesting, but there is a problem that not so many users' stories are so interlaced. In most cases, there is a story line belonging to many users.

### 3. Chart of Interests

The main goal of our visualization method is to provide a user with a global overview of a photo album, show him/her what and when happened, what were the most important events, reproduce storytelling etc. For this purpose we have proposed a Chart of Interests as an abstract of a photo album (see Figure 1). The Chart of Interests is a waveform placed in a chart where the x-axis stands for a time and the y-axis stands for an interest of events in the concrete time point.

The method is based on the idea the more pictures the user takes the more interesting the event is. The interest function in a given time is computed as a density of taking pictures during a time period. This is naturally true because when there is no interesting event people take no pictures or not more than one-two pictures in a long time period. On the other hand, when there is a really interesting event there is a need to document every second of the event.

The problem can rise because there are plenty types of photographers. In general, there exist three types of photographers taking three types of photography:

- *personal photography* - photography which is the widest spread and which we are mostly focused on. The photographers try to do a snapshot with a purpose not to create the perfect picture but to save the memories. This use-case is the most suitable for

our visualization because of the character of taking pictures.

- *art photography* - photographers try to take few perfect art photos of the event. However, also these photographers take more photos when photographing important events to be sure to create technically perfect photo in the right moment. Thus it is better to create visualization from the collection of all, not just from the best photos, to catch the right course of survived events.
- *documentary photography* - the character of the documentary photography is somewhere between the art and personal photography. It is widely used in journalism and thus it is also suitable in some cases for our visualization method.

We expect that we can more or less cover all types of photography but the visualization is proposed to fully support personal photography and its character.

#### 3.1 Visualized Properties of a Photo Album in the Chart of Interests

The Chart of Interests is a graphical overview of a photo album where the user can see a photo album context. This visualization method utilizes following features:

- *identification of events across a photo album*
- *chronological order of events*
- *identification of most important events of time periods in a photo album*
- *photo album placement in a time context*
- *storytelling*
- *navigation element which can be used as a supplement to single photo browsing (see Figure 2), photo album on a map presentation, events commenting etc.*

Thanks to the waveform of the chart the user gets to know the character of the events, the user can see whether the event was short and very exciting, or quite long and exciting at the beginning and then a bit boring etc. This approach supports the storytelling and helps the user easily navigate through the photo album. When there is no time to see all photographs from a photo album the user can go just through the most interesting events or through the events which he considers interesting according to a title or a photo representative of an event.

The most interesting events are visible according to local extremes of the waveform. These extremes have no meaning without additional graphical notation. Thus it is important to somehow identify these extremes in a way that it is clear which extreme belongs to which event. We have decided to circle the events in the chart to bring the user similar feeling as in the real world. It is natural for users to circle such information. People do this quite often. They draw circles around information on a paper to stress and highlight information. According to the area of the circle, the user can intuitively identify which event is more important than another.

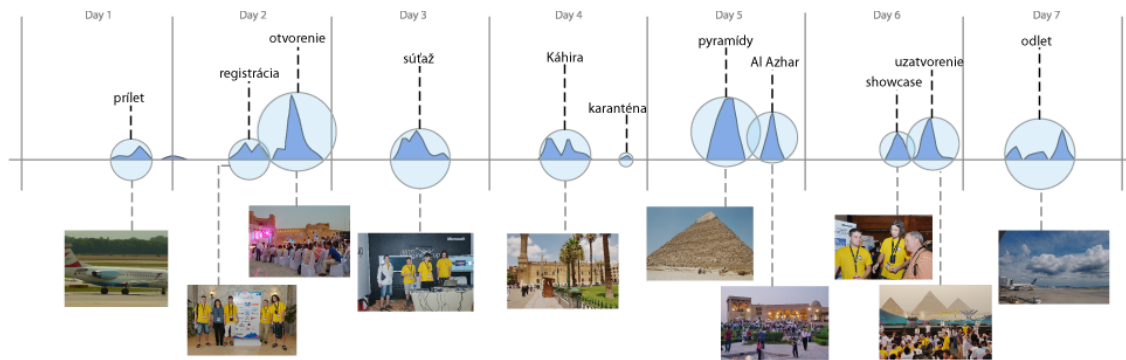


Figure 1: The Chart of Interests as an abstract of photo album.

Other way how to stress the event importance is via position of the event title. It is natural to place the title of the more important event in a higher position within the chart. The higher position in a chart is mostly considered as a higher value what should be the synonym to the higher importance of an event. This multiple stressing of single information eases the interaction process and enhances positive user experience.

Simplification principle is also used in the time depiction. We are not using classical time depiction on the x-axis in a manner of single unit time segmentation followed by number labelling. We have decided to use more pleasant way to bring the visualization also closer to users who are not such familiar with charts. To keep chart simplicity the chart is visually divided into 8 time segments at most which are labelled by well known calendar labels e.g. *February* or *Day 1* etc.

For each event we pick a photo representative which enhance the recall of memories and help users recognize the story of an event. The photo representative also personalizes the chart. For this purpose we also use a color of the chart. We analyse the photographs from the photo album and according to photograph color scheme we pick a representative color of the chart. This personalization helps user recall the character of the photo album. The assumption is that the summer photo albums will have summer colors, night photo albums will consist of dark colors etc.

The storytelling is supported by many aspects. The first aspect is photo album clustering into events followed by chronological order of the events. Thanks to event titles and photo representatives which are placed in the time context we have a basic plot of the photo album. The next aspect which supports storytelling is the waveform itself. The waveform shows the progress of the story. The most important part of storytelling itself is written text [4]. This we can achieve by allowing authors write initial comments and also allowing the users who browse the photo album to write replies to the initial comments. This way the users create a narration. It is a bit different than classical single photography commenting because the comments are closer to the photo album as a whole and thus it creates a more meaningful story.

Other important usage of the visualization is the use case of browsing single photos. We can easily visually place a photograph in a time and photo album context, and so let the user know when the photography was taken (see

Figure 2). Thanks to this the user can see the overall photo album context in every moment.

### 3.2 Creating the Chart of Interests

To preserve the simplicity we had to deal with creating of the chart. To make the visualization usable it was necessary to automate the process as much as possible. We had to make a compromise between the precision of the visualization and the simplicity. Almost all components of the chart are created fully automatically from photograph metadata. The exceptions are events and event titles. We have implemented a heuristic that estimates the number of events and cluster photographs into events. We are aware of the fact we cannot exactly estimate the events so we allow user to adjust the resulting events. Thanks to the semi-automation the chart is created in 5-10 minutes which we consider as an acceptable time.

### 3.3 Algorithmic background of the Chart of Interests

Single photograph in the chart is represented as a Gaussian function. We assume that the Gaussian function is a synonym to the development of the interest of an event, because the interest of an event slowly begins, then rises to the maximum and slowly drops. Final waveform of the chart is computed as a sum of the Gaussian functions of each photograph. According to the number of photographs we adjust the parameters of the Gaussian function.

The waveform is then normalized via logarithmic function to drop the maximal values and to raise the minimal values of the chart. There is a bigger difference between zero and one photograph in a given time and e.g. 100 and 101 photographs in a given time when we consider the interest of the event. There is still one photograph difference but the meaning of the one photograph is different.

To preserve simplicity we have to make a waveform smoothing, because the resulting waveform from the previous steps is too detailed. It is enough to present user with only the approximate outline of the interest of events and also our method is not so accurate to be so detailed. For the smoothing purpose we use Fast Fourier Transform.

Photographs from a photo album are clustered by the algorithm described in [5]. It is running threshold algorithm where the number of clusters are heuristically estimate. When we know which photograph belongs to which cluster we have to make visual correction of clusters which overlap too much. The big overlap is a problem when

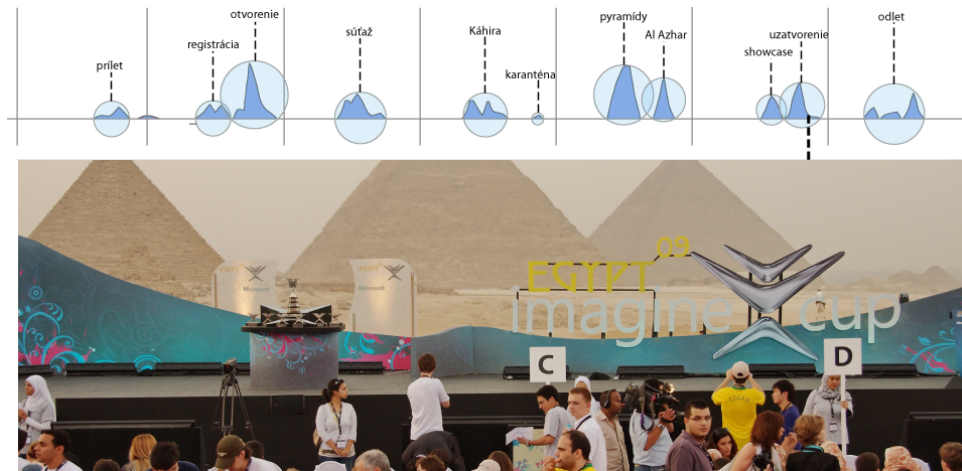


Figure 2: Single photograph browsing.

the chart is used for navigation and also causes a visual disturbance.

As a last step we use a custom force based layout to layout the event titles and photo representative of events. We have to avoid overlaps, because the titles would be unreadable. We use ad-hoc layout algorithm to place the elements on the chart. This way we assign each element an original position. In the force based algorithm the elements are repulsed between each other and attracted to the original position. There is also a repulsion priority in the y-direction, because the titles are much wider than higher and we want to preserve the x-position of the element.

#### 4. Conclusions and Discussion

In this paper we have described our photo album visualization proposal which we believe that can bring a user a global overview of a photo album. We think that this method is an inevitable result of character of contemporary photography. Our proposal is based on an experiment and we tried to include many necessary aspects of sharing events and memories. On the top of all we are not focused only on memories recall but also on photo album browsing. We expect that the visualization method can also shorten the process of concrete photograph look up.

We are aware that we are not covering all aspects of photo album visualization, but we have made further proposals to complement The Chart of Interests. We cannot implement all visualization aspects in the chart because it is necessary to preserve the simplicity. The simplicity is a trade-off between user experience and functionality. The Chart of Interests is proposed in a way that it can be easily supplement with a map, when the visualized events are placed on the map, the events can be commented as a whole etc.

We have implemented The Chart of Interests and showed it to very few people. Current results show that this visualization method can be valuable contribution in memories recall and recognition. The most interesting parts of visualization appear to be the event identification and navigation via event circle depiction. The next very useful part seems to be placement of events in time context and identification of most interesting events. We expect that the depiction of interest in the chart can be hardly under-

stood for some not computer-skilled users but we think that this functionality can be easily explained. Further usability tests and comparison to the existing methods will show us the real state of our goal achievement.

As a future work we plan to utilize the function of interests. When we can identify the most interesting events we can make a photo album compression, because we can estimate the number of photographs which should be presented from given parts of a photo album. Connected to event identification and basic photography rating we can shorten the time needed to go through the photo album when there is not so much time to see all photographs. It can also be very interesting to look for similar events or photo albums according to waveform of interest. Looking for similar photo albums can be a tool useful e.g. in recommending systems, it can help better socialize among users etc.

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