
Photo Khipu: Organizing a Public Record of Social Transaction

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Abstract

Traditional photo albums are important not only for storing and organizing photographs but also for their ability to display photos in an aesthetically pleasing manner. A beautiful photo album augments the browsing experience for individual recollection or sharing with others. We present a digital photo album that organizes and displays photos in a form based on an ancient accounting device, the Incan khipu. The khipu metaphor provides an overview of the photos in a collection and a historical record of individual albums. This interface is meant to be an evocative and functional interactive display in the home for visitors and occupants alike.

Keywords

Visualization, Photo Sharing, Social Computing

ACM Classification Keywords

H5.3. [Group and organization interfaces]:
Collaborative computing, Organizational design

Introduction

A photograph records one moment in time and is treasured for its beauty and the memory it preserves. A collection of photos provides more information still and can span across lifetimes and generations. These photos serve, among other things, as a social record [3]. Such social records portray a valuable portion of a personal history.

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The ability to view a collection of photos in the “big picture” highlights social habits as patterns of interactions over time. Acting as a “metaphotograph”, Photo Khipu displays these and previously unnoticed patterns in albums such as the number of people who appear in a photo collection and at a point in time.

What is a Khipu?

A khipu is a collection of strings and knots used by the Inca for accounting and tax collection (see figure 1). While a few modern khipus are in use today, their original encoding is lost. Each khipu has a primary cord from which pendant cords are hung. In addition, each pendant can have ten to twelve subsidiary cords, as well as three kinds of knots. The knots have numerical significance as well as structural significance encoded in strand color, knot type and position [7, 12].

We chose the khipu metaphor for its beauty, material simplicity, and structural complexity. The system of knots and cords provides information about an entire photo collection in one visual. As a semi-public display in a living room, our Photo Khipu gives visitors to the home a glance at a family’s shared memories. These guests can find patterns in the family’s photo-taking habits, identify social events, and discriminate between urban and landscape photos. Alternatively, such a display in a university department setting could encourage cohesiveness among students, faculty, and staff while providing alumni a chance to reminisce and see community changes. Visitors and prospective students would gain insight into the community. In this way, Photo Khipu serves as a social catalyst [4].

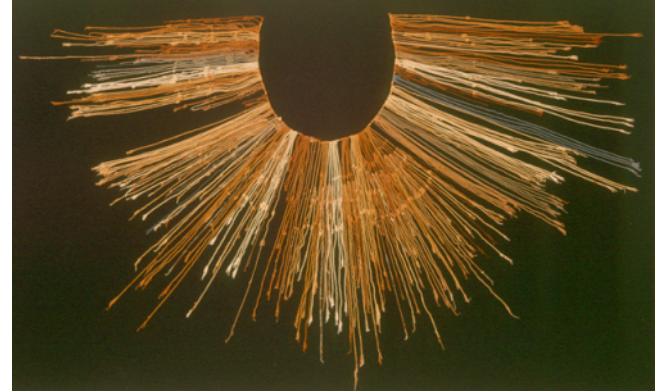


figure 1. The Incan khipu is a record keeping device of strings and knots. Knowledge about the content encoded into the structure has been lost. Image source: Wikipedia [13].

Related Work

Simple browsing features such as folders, thumbnails, and timelines make digital photographs easier to manage than non-digital photographs [11]. In Photo Khipu the folders are represented as album strands that are organized by time. Thumbnails are available, but are not the initial representation of the photo. While many organizational systems aim to provide information about the collection with thumbnail representations [6], displaying a collection of images as rectangular thumbnails can be visually confusing and difficult to scale. Various photo representations use a stacked photo metaphor to show collection size [5]. These stacks portray information about the size of each group at a glance but are harder to manipulate spatially. Our approach is to abstract away the rectangular form of a photograph to make specific patterns salient. In the process, we aim to create an aesthetic exploratory object for the home. By using a

figure 2. A portion of an album strand from a department picnic. Most of the pictures are individual portraits while a few are group shots. The general red/orange tone is representative of skin tone.



larger public display meant for several people, it also emphasizes group interaction, search, and conversation [8].

Structure

In Photo Khipu, the visualization serves as a table of contents. Each photo is represented as a knot on an album's pendant cord. For the purposes of the visualization, a photo album is a group of photos that share a common attribute such as event, time, or location. There are various methods for grouping photos into these albums [1, 2, 9]. In this work, we focus on the interaction and the visualization of Photo Khipu, rather than the authoring environment. Our current implementation uses photos that are grouped by date and arranges the albums by time.

Different Types of Knots

Like its Incan counterpart, Photo Khipu uses knot type to convey extra information. However, what kind of information should be displayed about the photographs? A large number of different knots with different encodings would prove complicated and hard to remember. Textual data should be used sparingly to avoid clutter and chaos. Instead, we chose a simple design with two knot variables: color and number of people. Our final design represents each photo by a translucent circle whose radius is related to the "social magnitude" of the photo. The social magnitude is defined as the number of faces found by a computer vision library [10]. The color of the knot is the color of the central pixel. We found that central pixel color was more representative of an image than a pixel color average. In order to increase the legibility of the visualization, we map the color to a value in our Khipu color map. We restrict the possible hue values while

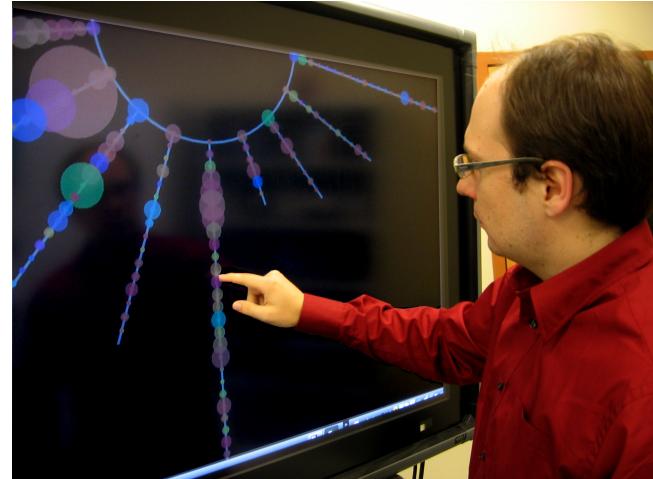


figure 3. The Photo Khipu in use on a SMART Board.

keeping saturation and brightness constant. This representation allows the user to identify more sociable photographs. Over time, a user can see how a social event progressed or evolved, or at least the interests of the photographer (see figure 2).

Arrangement of the Strands and Knots

To connect the previously mentioned features and to show a timeline, we must carefully consider the arrangement of the cords and knots.

Pendant Cord Position along Primary Cord

A pendant cord (photo album) is positioned along the primary cord (main ring). This cord is arranged by album date where each album is composed of a particular day's worth of photos. Remaining albums are placed after the temporal albums. In the future, we would like to explore alternative ways to position

figure 4. The index of a personal photo collection where each horizontal line is an album. The albums are arranged by time and the length is representative of the number of photos in the album.

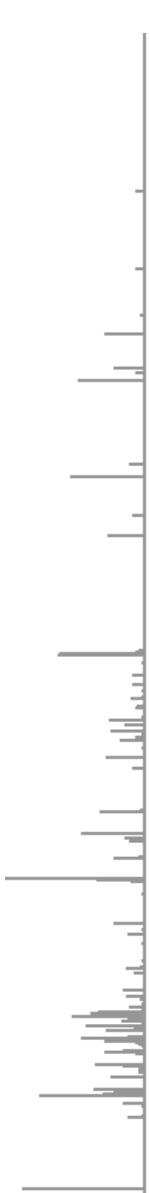
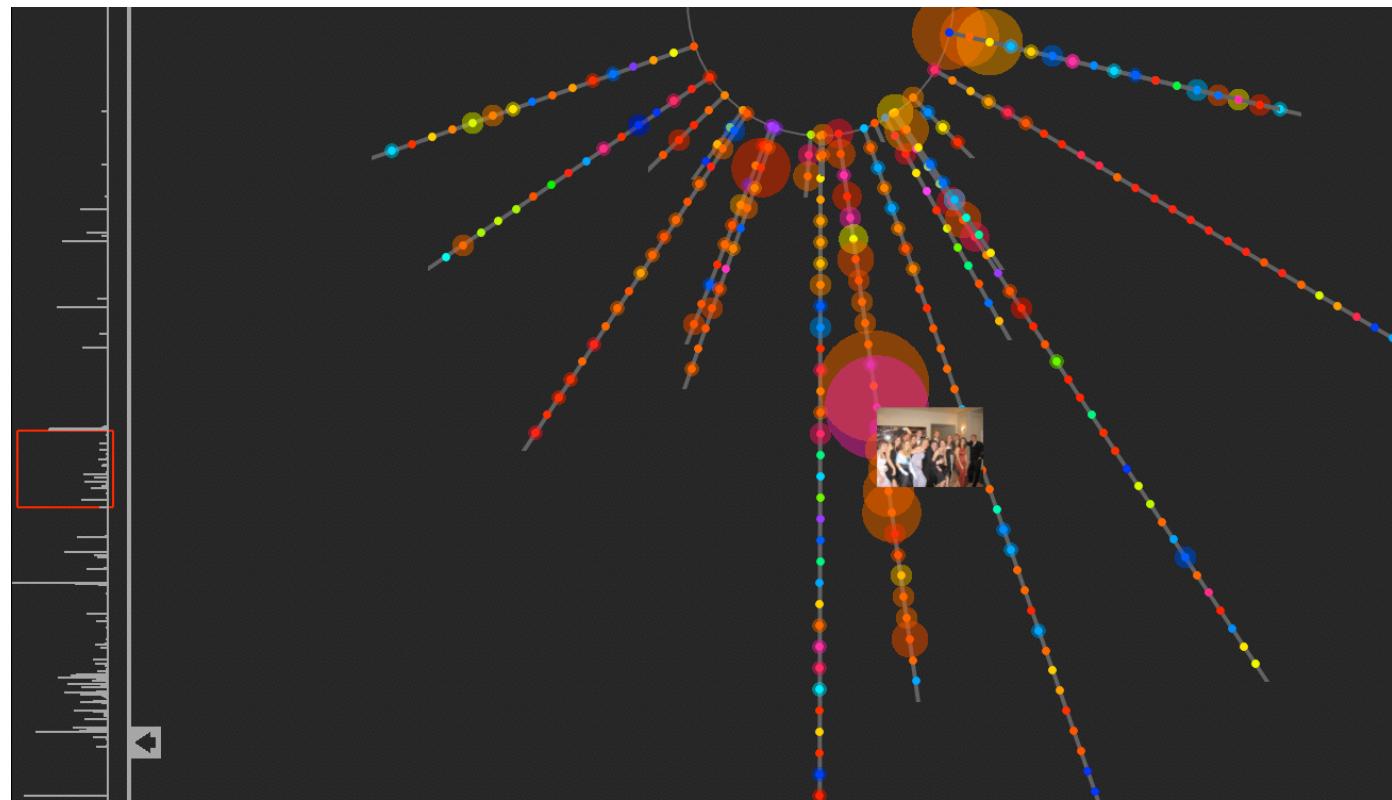


figure 5. The visualization to the left shows the index to Photo Khipu where each album is arranged vertically by time. The length of each horizontal line is indicative of the size of the album. The red box show which portion is currently in view. The size of the box is changed by dragging the bottom up or down. Hovering over a knot displays a thumbnail.

albums that are organized in other categories such as social groups or annual events.

Knot and Subsidiary Cord Position

As stated earlier, a subsidiary cord is a sub-album; each knot is a photo. We currently arrange them about the pendant cord in the order the photographs appear in a folder. This corresponds to the order the photos were



taken. Future work will explore equidistant placement, proportional time placement, as well as user defined placement.

Multiple Owners

It is not uncommon for people, in a family for instance, to pool their digital photos together. When a group of

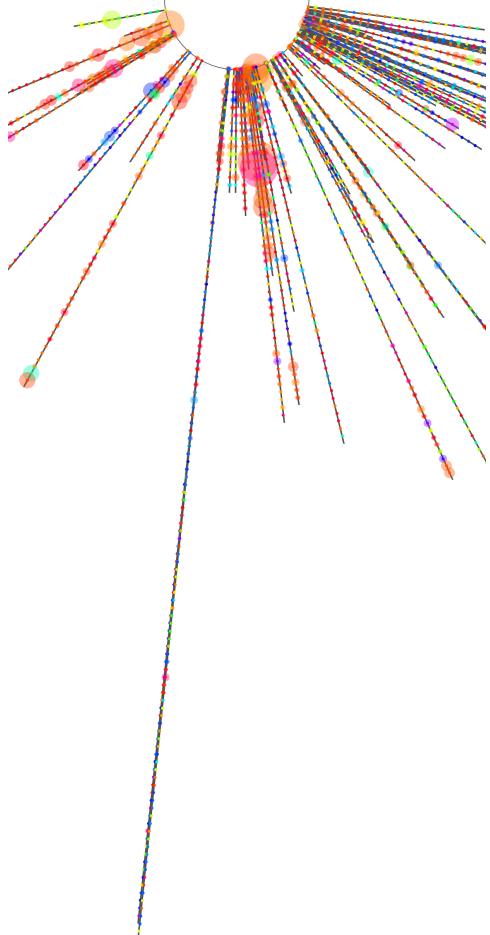


figure 6. A view of Photo Khipu where all albums are shown. This collection contains over 3500 photos.

friends goes to the beach, four or five people may take photos and everyone will want a copy. However, it can be beneficial to group the photos together while still maintaining information about the photographer, or the owner. In Photo Khipu, when a user selects an album cord, the cords that have the same owner are highlighted by making the strand slightly thicker. This feature encourages interaction with the display and provides a starting point for further search.

Interaction

With a large photo collection, it can be difficult to select a particular album or photo to view (see figure 6). Photo Khipu deals with this by allowing strands to slide apart or together allowing the user to select which portion of the collection is shown. To the left of the khipu, the user can open the index visualization (see figure 4). This visualization shows album size and position in time for the whole collection. A red box highlights which portion of the collection is currently shown. The user can move the box along the index to change the khipu position. Also, the user can change the size of the box by moving the bottom edge up or down. Additionally, a user can drag her hand across the visualization to rotate it about the primary cord. Our current implementation uses a single touch SMART Board¹; however we plan to move the visualization to a multi-touch screen to better allow for several concurrent users. The user could then use both hands to separate cords to single out a particular album. To view several albums concurrently, the user would gather the cords together in a compressing motion.



figure 7. Full view of a photo in Photo Khipu. The appropriate album strand is displayed to the side.

To view a thumbnail of the image, the user can hover her finger over a knot (see figure 5). When a user selects a knot, a larger version of the image is displayed on the entire screen. From there, the user can navigate to the next or previous image in the album (see figure 7). A view of the album strand is also provided to show relative location within the album.

Discussion

We designed Photo Khipu to explore personal histories of social transactions. We currently look at:

- Who took the photographs?
- When were the photographs taken?
- How many people are in a photo?
- What distribution of photos contains people versus landscapes?

¹ <http://www.smarttech.com>

Photo Khipu highlights photographers by linking albums that belong to the same person. The arrangement of the albums by time provides a sense of history and context, while length can indicate importance. Knot radius shows “social magnitude” and reinforces the social importance of an event. This can also be used to identify photography habits within the collection and in combination with color can be used to distinguish the emphasis of an album before seeing the photos themselves.

In summary, we presented a design for a new type of photograph as an aesthetically pleasing, interactive social catalyst for a semi-private space. This “metaphotograph” presents the organizational structure of a collection of photographs with an emphasis on the social data held within the collection. We introduce the idea of “social magnitude” of a photograph, and begin to distinguish between photograph locations. Through a visualization based on the ancient Incan khipu, users can explore past social transactions while sharing their photos and experiences with others.

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