Timescapes: Putting History In Your Hip Pocket

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Abstract

In this work we discuss our efforts to use the ubiquity of smart phone systems and the mobility they provide to stream historical information about your current place on the earth to the end user. We propose the concept of *timescapes* to portray this historical significance of where they are standing and allow a brief travel through time. By combining GPS location, with a rich media interpretation of existing historical documents, historical facts become an on-demand resource available to travellers, school children, historians and any interested 3rd party. To our knowledge this is the first introduction of the term *timescape* to be used in the context of historical information pull.

1 INTRODUCTION

History is often seen as a subject for textbooks, composed of little more than a series of facts. It can be difficult to relate to past events if you feel disconnected from the time and place being presented. In an effort to help contextualize time and place, we set forth to bring history to where you are currently and provide a rich media experience when receiving information about the history of your current place. We hope to make learning and visualizing history an on-demand service that brings back the context of where and when.

With the ubiquity of mobile devices capable of taking in content and displaying rich media presentations, it is now possible to have access to unprecedented volumes of information in a litany of general formats. This combined with the GPS systems now standard in every phone means access to information tied to geographic present location is common. However, little has been done to provide historical information based on geographic location[12]. When we combine this concept with the richly documented histories of humanity since the invention of the camera, it is not difficult to imagine historical documentation of the future being tied very tightly to geographic location.

In this paper, we discuss our concepts on historical information provision based on geographic location. We neologistically use the term "*timescapes*" to represent a series of historical facts be they in documents, paintings, recorded oral histories, interpretations (in fiction or films), images and/or videos that are streamed to a user based on the location information provided by the GPS in their smart phones. We continue this work in Section 2 by defining timescapes and presenting some examples. We then proceed with a description of the system architecture that makes such a concept possible. We follow with an evaluation of User Interface, User Experience issues we were confronted with and conclude with a discussion that includes some open problems encountered during our work.

2 TIMESCAPES

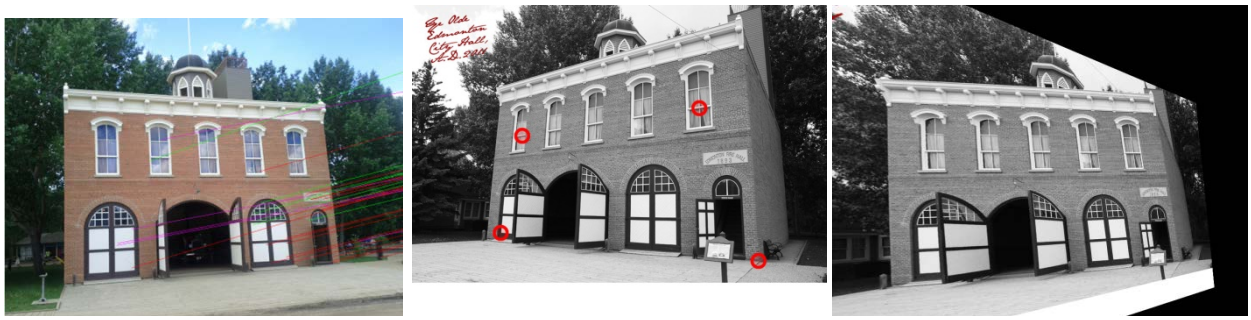
The idea of time travel has long inspired many a young scientist and fiction writer as it is an unreachable scientific endeavour. Rather than send a person to a specific point in time, we examine what happens when a person is at a specific place, and history is layered around them. On the grander scale, we are able to bring an entire timeline to a person that is predicated on a specific place on the planet.

Imagine being at the Palace of Versailles (located in a southwest Paris suburb) in 2012. A timescape for your location would include a hunting lodge for King Louis the Thirteenth, construction of the Imperial Palace directed by Louis the Fourteenth with landscaping and gardens between 1668 and 1684. As well, the transfer of power from Paris to Versailles by Louis XIV and Versailles Palace being home for royal family of France from until 1789. During the French Revolution in 1789, the looting of Versailles and Prussia's King William the First was

made emperor of Germany in a coronation ceremony in 1871. And, on June 28, 1919 the Treaty of Versailles treaty marked the official conclusion of World War I.

Now further imagine that information being streamed directly to your smart phone with pictures of the key players, artists renditions of the construction and a signed copy of the 1919 treaty. The contextualization of what has happened in the place you are standing by bringing some 400 years of history to your hip pocket on demand is staggering. All of these things happened... right where you are standing, and the contextual bond of space and time is facilitated through the access to historical layers and allowing them to visualize the history of this place.

We call this experience a timescape. Timescapes can be made possible with any amount of text, audio, video, in a number of multimedia presentations. In the figure below, we see the historic Fort Edmonton building in a modern photo (a) and a historical photo in (b). In this example, historical photos don't have to be particularly old, but rather they are photographs from the past. In (c) we have the result of warping the historical photo using a homography [3] computed from the dominant plane indicated by the historian by the 4 red circles in (b) and their corresponding points in (a). Finally, we overlay the two images for display of the timescape. We have several opportunities for display, including alpha blending [8] the images so that a user can blend between photos throughout time, or as we have done here in (d) create a collage with both the modern and historical images combined into one. The interactive possibilities with this example allows users to "wipe" the historical image in and out over the modern photo. This method is one that is suitable for dual image timescapes.



(d)

Figure 1: Fort Edmonton Historic Building Street Matching Example. a) 2012 photo of the building b) Historical photo of the building (note the missing block on the roof) c) Warped historical photo to match view point of modern photo d) merged image modern on top left, historical on bottom right. [10]

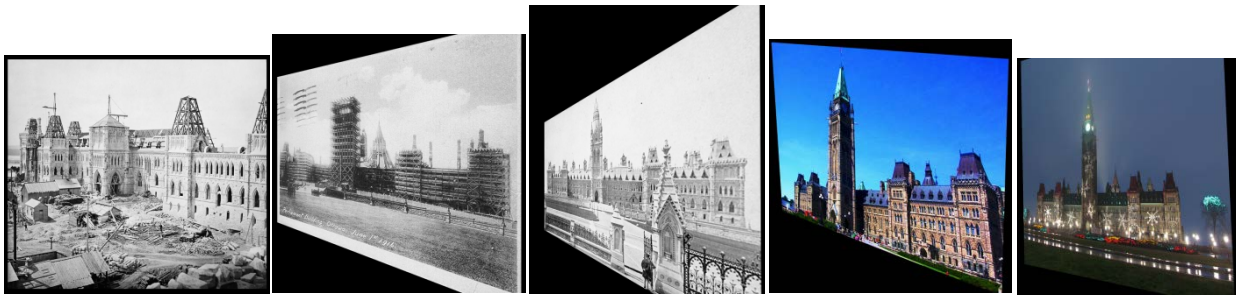


Figure 2: Images of the Canadian Parliament buildings from 1863 on the left to modern day on the right. These images are warped to a common viewpoint to be overlaid upon one another to create a visual time travel effect.

Another example of a timescape presentation, this time with a larger dataset, is the construction of the Canadian Parliament Buildings. In Figure 2, we see images of the construction ongoing of the Peace Tower throughout several years. All of these images have been warped to a single viewpoint so that they can be layered one top of another and provide the user the opportunity to scroll through time. This effectively lets the user see the buildings from the time they were constructed though to a modern image, all in a consistent view, by using image warping to the dominant plane and alpha-blending to create a seamless interactive that allows one to travel though time visually.

Figure 3: Screenshot of timescape delivered to client device consisting of images and text.

These are only two examples of the kinds of interactivities we can create to allow a user to play in time by using relatively simple image processing techniques to present historical visual data to the user in a chronological way, allowing the user to experience time travel for that specific view point. The idea of a timescape, does not have to be limited to images that can be visually aligned. Image of related documents and textual explanations can also be provided. Going back to our Versailles example, it is completely reasonable to provide a copy of the 1919 treaty as part of the timescape presentation. In Figure 3, we see a screen shot of a multimedia timescape delivered directly to the client device based on their GPS location.

Finally, it is important to note that a timescape is a coherent linear timeline and presentation. It must, therefore, be in chronological order. A display of randomly ordered historical facts or documents is insufficient to be considered a timescape as it would not present a coherent vista through time.

3 SYSTEM OVERVIEW

The system was designed using a standard client/server model with an Apache based service model. Client side software was developed for the Apple iPhone. An interface for navigating through a number of available timescape data sources and for displaying various modes of timescape data deliveries are the key interfaces. Finally, storing favourites and navigating multiple timescapes that are available in their general location were secondary interfaces.

The server part of the system is a backend data repository using an SQL database to store the historical information and associate the information to a GPS location. The primary keys in the database

are the GPS coordinates that represent the closest possible point that can be determined by the heritage professionals as the location of the historical events represented by the media objects (images, video, text etc). The server delivers the historical content to the client based on GPS location and an initial request for content. However, the server will first provide the client with nearby timescapes that are available in the area based on the client's location (sent to the server by the client in a formalized request).

The client application, developed as an iPhone app has two key modes: Locating timescapes and subsequently displaying timescapes.

(a) (b)

Figure 4: Screen shots of the timescapes location interface and the timescapes display interface.

In order to locate the timescapes, the client sends the server a request with its GPS coordinates and the server will respond with a list of timescapes available in the client's geographic proximity (Figure 4a). The interface was implemented using the Google Maps API [2]. The user can then select any one of the timescapes pins and receive the timescape display screen(s) to visualize their current location throughout time by using the slider bar interface in Figure 4b.

4 UI/UX DESIGN

As much as possible, we endeavoured to follow a User-Centered Design (UCD) process [5]. Generally speaking, UCD is an interface design process that heavily considers the desires, requirements, and limitations of the end users of a product. UCD is an iterative problem solving process requires that analysis of how users are likely to use a product and to test the validity of the design real world tests with actual users. Since it is quite difficult to intuitively predict what first-time users of a system will experience, UCD helps to improve the end product at the time of delivery. User-centered design tries to optimize the interface around how users expect to use the product, rather than forcing users to adapt their behavior to accommodate the product design.

There are two key User Interface (UI) and User Experience (UX) bases for us to consider. The first set of key users are the heritage professionals who are inputting data into the database and need to manage the various media content that is to be made available. The second key sets of users are the end users of the application who are pulling historical information to their location on their smart phone.

The data input interface was designed to allow the historians to effectively document, using text and image resources, the historical events for a given place. The historian had multiple pathways to insert the GPS coordinates for the historical information. The primary method was to capture the location using a GPS system while on site and subsequently store it into the database. A secondary method, allowed the historian to use a map-based interface through a web browser to approximate the location. The remainder of the data entry system was form based, implemented as a series of web pages with content fields to be filed. Data integrity checks and record completeness were two major factors necessary to ensure that mistakes were not propagated directly into the database. Access to the data entry system was independently secured.

The end users were iPhone/iPad users (as this is currently the only supported platform) and as such we were limited in the interface mechanics. To ensure the app was easy to use, it had to follow standardized iOS Human Interface Guidelines [4] for Aesthetic Integrity, Consistency, Direct Manipulation, Feedback, Metaphors, and User Control. We were able to design unique user interface elements in the timescapes interface. To this end, we desired a simple interface for a user to scroll through a number of images that were delivered to the client in chronological order. Several iterations were examined, including a photo book layout with thumbnails, a standard iPhone image gallery and the scroll bar with cross dissolve effects

implemented with simple alpha-blending. User tests indicated that although the timescapes interface was foreign, once understood, it was vastly the preferable method for going through the images that were delivered. The timeline on the scroll bar was a well accepted metaphor for time travel and the seamless transition created by the alpha blending allowed the user to "fly through time" but still allow them to stop at any particular point in time and see any two consecutive images of the timescape blended together at any alpha level they desired. Figure 5 shows an example of two images alpha blended to shows historical differences between the two images.

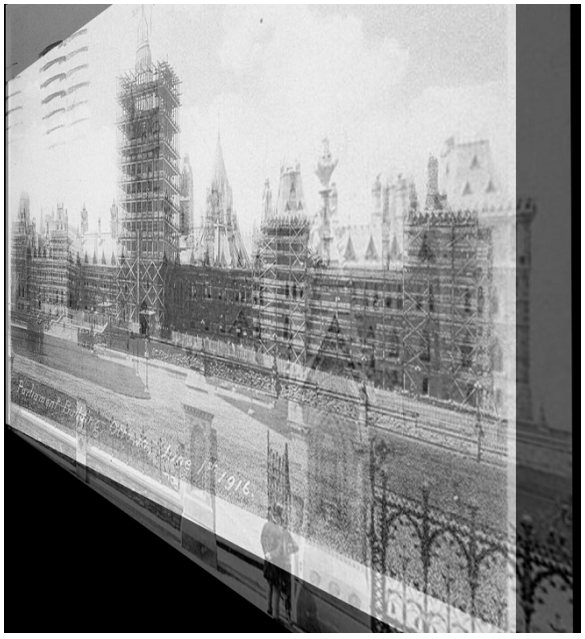


Figure 5: Blended images displaying features from construction in 1916 and finally complete in the future. Notice the roof from the future and the scaffolding from the past.

5 OPEN PROBELMS

Within the scope of our development, we encountered a number of issues that remain open. There are numerous possibilities for dealing with video, text and other media types that can create a timescape presentation. In this paper we examined only two options for visual data and still imagery, however we still need to examine in more detail how augmented reality [9] could be used to overlay historical paintings onto live images captured by a hand held device. Moreover, as the concept of a timescape is to include a chronological series of media documents for a singular place on earth we have intentionally omitted data sources such as sound, radio broadcasts, video and television. There is much work to be done to design and implement timescapes presentations using the full gamut of media formats available, particularly as we reach into archives of recent history. To compound this timescapes presentation problem, we also have to consider how multiple interpretations of historical events should be portrayed. Are multiple timelines a feasible interface? And, how might we resolve conflicting documents that appear within the same timescape? Timescape presentation remains an interesting open problem from a media design point of view as well as a historical interpretation point of view.

The creation of good multimedia displays of timescapes required image matching of features to compute homography matrices to allow the image warping. We originally assumed that feature matching between old historical photos, that were scanned in, and modern images taken with digital cameras would easily match using feature matching techniques such as those described in [1][6][7]. However, experience has proven quite challenging to automatically match these image pairs. We hypothesize that issues such as camera lens quality, paper degradation, and modern compression artifacts all play roles in making the matching unsuccessful. In our efforts, we had to resort to a lot of manual intervention to identify planar regions in both the historical and modern photos to allow image warping to succeed. In many cases, our timescape image sets were unable to be warped to a common view point and are simply presented unmatched. Our particular heritage site, the Rideau Canal, proved to be difficult because of the nature of the sites themselves. The images were full of trees and vegetation that made automatic matching difficult. A more distinctive architectural case study with more rectangular surfaces would perhaps help to overcome this problem. However, this remains an interesting open problem that has significant ramifications for many future applications that may choose to use historical image data.

6 CONCLUSION

In this paper we present a system developed to examine the ideas of timescapes, a concept that allows history to become an on demand service and facilitate a limited possibility for time travel. By anchoring historical reference data to GPS location, we are able to offer users in insight to historical events that occurred directly in the place they are currently. We expect that such a system provides context for historical facts and documents that have been delivered to users. The system is available in the Apple App Store for iPhone users and more information can be found on the website [11].

This works coins the term *timescapes* to mean a representation of a collection of historical documents in digital form to facilitate a "sense of 'time travel'" by anchoring our recordings of history to geographic locations. Moreover, it begins to scratch the surface of timescape display modalities and presents a number of open problems that require resolution in order to make timescape presentations a more automatic process.

Acknowledgements

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