The TerraScope:
Whimsical Image Discovery and Exploration

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Abstract

The TerraScope is a periscope inspired device that allows users to explore images and remote locations as they move. We reference previous approaches to tangible, multi-dimensional image browsing and viewing interfaces and present the motivations for designing our device. We then describe the mechanical and technical implementation of our design. Finally, we close with a preliminary evaluation of our findings and avenues for future exploration.

Keywords

Periscope, discovery, visual perspective, location based images, global images, exploration, tangible interface, geo-tagging, exploration, image browsing

Introduction

The Web has greatly enhanced the way people discover new places. With just a few search terms and keystrokes, people can find and visualize far-away worlds through photographs and other rich media. However, the world remains a vast place difficult to physically explore without the luxury of disposable income, time, and the right travel documents. Despite improvements in image retrieval and browsing, viewing digital images on a computer or mobile phone tends to be unidimensional. Desired content is found and retrieved by typing keyword searches or following links. Returned results often present hundreds of images for the user to browse at once--and just as easily discard and forget. The experience of "exploration" in space and time is lost. There is no sense of relative distance when the experiences of viewing an image of the other side of the Earth and an image of the park across the street are the same. In both cases, the process is stationary, executed using simple keystrokes and mouse clicks, and conducted from the comfort of one's computer desk. The experience of exploratory wonder is minimized in exchange for convenient image retrieval. We attempt to introduce a sense of distance to image browsing and exploration by imposing space between the image and the viewer and building physical movement into the image retrieval experience.

Previous Work

Previous approaches explored incorporating enhancements or additional dimensions to image viewing including: time [1], tactile materials [2], supplemental multimedia [3,4,5], and demographic data [6].

An improved exploration experience was a driver in past projects like "The Blankenship Camera" [1]. As one of the earlier approaches to adding multi-dimensionality to digital image viewing, this camera uses a Global Positioning System (GPS) device and a digital compass in conjunction with historical image metadata as a way to retrieve and display images in order to educate students about historical changes to their communities. Similarly, the "Periscope" is designed as an educational tool to "allow children access to information that would not be available to them within the context of a conventional field trip." The creators use the form of a periscope for their device to "provoke and then to intrigue children" encouraging use and discovery [4].

The goal of the "Periscope" by Jim Youll at the MIT Media Lab [3] is to add dimension, distance, and a sense of time-ordering to media on the Web. The project uses the metaphor of a real periscope as an easy-to-understand tangible device that a person can "aim" into the world to find associated images. Similarly, the "Real Binoculars" [2] project uses a set of binoculars to facilitate exploration by matching "user expectations with the tool's capabilities, enhancing the sense of presence and increasing the depth of interaction between real and virtual components of the scene." While some past projects have focused on devices to capture "visible" data, the "Datascape" created by Erin Kabisch [6] is a periscope device that allows a person to view invisible demographic data associated with the visible places they explore. In "The Tunnel Under the Atlantic" by Maurice Benayoun, the artist creates a virtual tunnel that connects Montreal and Paris using animation and a modified video feed, which the artist says makes people think of a "linear crossing of our planet" [6].

Motivation

Our goal throughout the design process was to facilitate the exploration of images. We wanted to introduce the dimensions of space and distance to image exploration, aspects largely absent in modern, computer-based image retrieval. We aimed to achieve this by requiring user movement for new image retrieval and by inserting physical distance between the image and the viewer. The movement required for image retrieval serves as a reminder that each image the user views is associated with a physical location. In addition, we used the metaphor of a tunnel through the earth to remind the user that the retrieved photograph represents a remote location on the other side of the earth. Together, this movement and imposed physical viewing distance serve to evoke a sense of wonder and whimsy while viewing images.

Project Design Overview

The realization of our design goal is the TerraScope: a tangible periscope-style device that encourages exploration of remote locations using images and device movement. The TerraScope's physical form is inspired by vintage optical devices like the periscope, stereoscope, and spyglass. These devices evoke feelings of exploration, fun, and observation. Similar to many of the related projects, we use the expected behaviors of the influential interface object, a periscope, to inform our interaction design. However, unlike an actual periscope, the TerraScope "tunnels through the earth", rather than reaching above a surface, to facilitate an otherwise inaccessible perspective. We mapped image panning to a periscope's rotational behavior traditionally used for surveying the field of view. Using the device, people gain a new awareness and perspective for a region of the world not immediately accessible to them.

Interactive Prototype

In order to test the TerraScope, we created a full-sized, working prototype (see Figure 1).

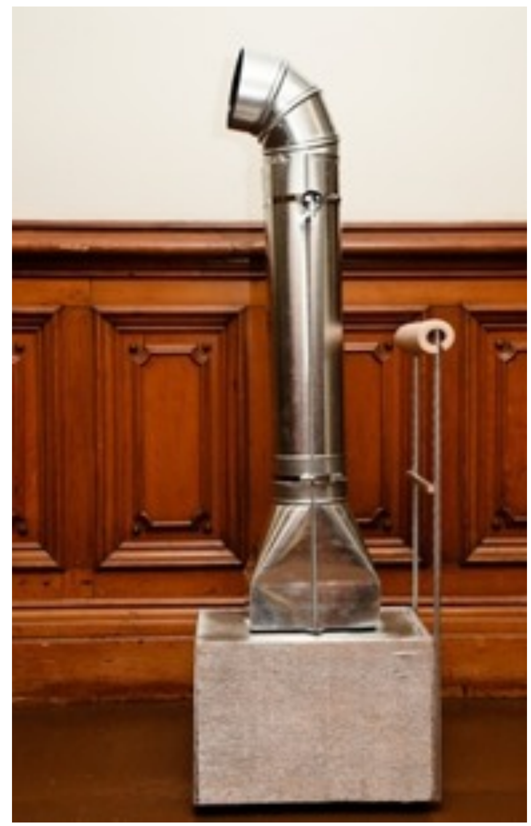

figure 1. The TerraScope prototype.

Physical Form

The TerraScope's physical construction consists of two main sections attached together: the viewing tube and the movable base (see Figure 2 and 3). The viewing tube is constructed of six inch diameter sheet metal ducting that is approximately four feet tall. The interior is painted with a matte-black paint to minimize glare and reflection. The view port contains a six inch opening with a mirror placed inside and angled at approximately 45 degrees down into the base. Two handles are placed equidistant on each side of the viewing tube to mimic the affordances and facilitate movement reminiscent of a standard periscope. The base is a a rectangular box (approximately 24" x 18" x 12") made from an old kitchen cabinet spray painted metallic silver to maintain an consistent industrial look. A lazy susan is mounted on top of the base and attached to the viewing tube, so that a user can grab the handles and rotate the tube 360 degrees. The bottom of the tube contains a seven inch LCD monitor. A "shopping cart" style handle is attached to the base along with four cast-iron casters, allowing the user to easily move the TerraScope for new image retrieval. The base has a door for maintenance and setup. It houses a laptop computer, connected to the seven inch LCD monitor in the viewing tube, and a smart phone (an Apple iPhone).

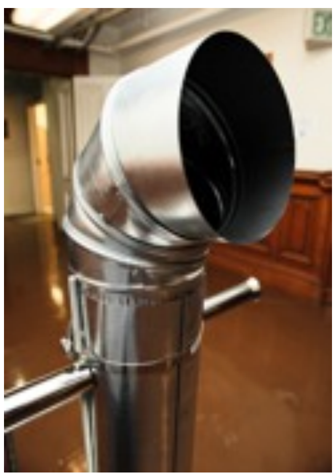

figure 2. Viewing tube and view port.

figure 3. Base cabinet for laptop and phone.

Technical implementation

GPS devices imposed several constraints due to their limited indoor functionality and an accuracy of 20 feet or above for even the best devices currently on the market. For purposes of prototyping, we decided to use fixed latitudinal and longitudinal information and detect the TerraScope's movement using accelerometer data from an iPhone. We used a freely available iPhone application called Accel Data to stream real-time movement data to a the laptop. The laptop, in turn, runs a python script which pulls in the accelerometer data from the iPhone. We modified the python script to detect whether or not certain movement thresholds from the iPhone are reached when the TerraScope is moved. If significant movement is detected, a web browser window opens on the computer, retrieves an image based on geolocation data from Flickr and displays it. The computer is connected to the LCD monitor, which is then reflected in the mirror of the viewing tube and out the view port.

Additionally, while Flickr has the largest, freely available set of geo-tagged images, it does not provide an unlimited source. The experience of the TerraScope is highly dependent on the availability of geo-tagged images. Currently many geo-tagged images exist in well-developed urban areas, but are much scarcer in rural or undeveloped regions. Images are especially scarce for regions covered by large bodies of water. When faced with a lack of exactly matching images for a geolocation, an image with the nearest geo-tags are retrieved. We decided this behavior was acceptable because an image with exactly matching coordinates is not required to stimulate the sense of interest, wonder, and distance we aim for with the TerraScope. During a demonstration in Berkeley, California, we retrieved images from Reunion, an island in the Indian Ocean, which was actually about 1000 miles away from our actual source origin. As geolocation data becomes more common in digital images, the proximity and variety of images displayed by the TerraScope should improve.

Interaction

When a user peers through the view port, they see an image in the mirror. The image is displayed on the small monitor at the top of the base. The tube and the mirror put distance between the image and the viewer, lending to the feeling of looking through a tunnel or physical object and serving as a reminder to the user of the distance between themselves and the viewed location. Once a user moves to a new location, a short, animated message appears, indicating to the viewer that they are "tunneling through the earth." When the user comes to rest, the image appears and is accompanied by a message underneath broadly describing the viewed location (e.g. "off the coast of Madagascar", "in the Gobi Desert"). The team added the interstitial animation and message to provide feedback to the user that they were viewing images on the opposite side of the earth and to make it clear that their movement triggers image change. Images larger than the monitor can be panned left or right by rotating the periscope accordingly with respect to the base.

We also wanted to minimize the feeling that images were being viewed on a computer. The periscope form factor put physical distance between the viewer and the computer. However, we also minimized the presence of the web browser displaying the images by running it in full screen mode. This helped limit the user to seeing only the tube, the image, and the description of location (See Figure 4 and 5).

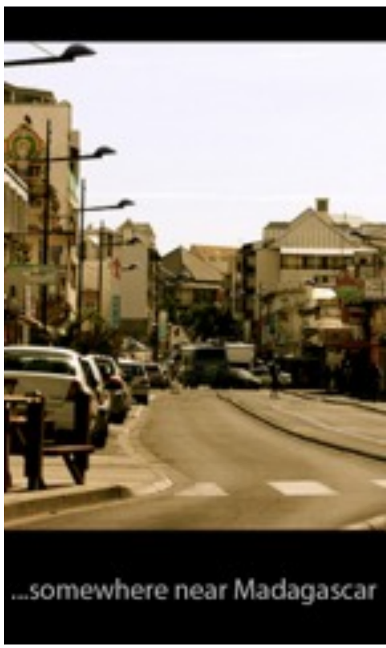

figure 4. Image displayed on display in viewing tube base.

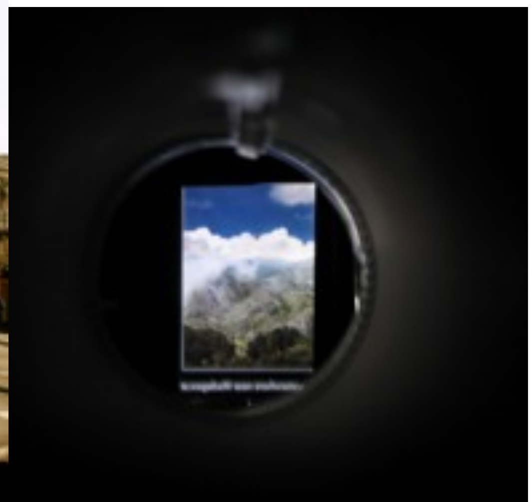

figure 5. Image and viewing tube as reflected in the mirror.

Initial Evaluation and Future Work

In order to obtain initial feedback, the design team displayed the TerraScope at the UC Berkeley School of Information in December 2009 to an audience of faculty, students, staff, and community members. In general, people liked the design aesthetic, pleased by the cohesive look of the device. However, some users suggested that the device looked like an "oven" due to the stove-pipe nature of the viewing tube, but thought it still encouraged interaction and remained enthusiastic about the form factor. As one user put it, "I like staring into the tube. Mechanically, it communicates well."

We noticed that, initially, people were afraid to touch the device or look into it. However, once they started using the TerraScope, people moved around with it quite a bit. Once they were moving, it was not clear to all users that the TerraScope must come to rest for a new image to load.

By far the most frequently cited interface request was the ability to zoom in to or out of images by pulling back or pushing forward the viewing pipe. We anticipated this request and consider this a high priority for a second version of the prototype. Other users were also interested in mapping image browsing controls to the handles of the periscope, which we also consider interesting for future exploration. A few testers mentioned the personal nature of the device. While these comments were meant positively, future research may reveal interesting ways to include collaborative viewing and sharing, perhaps by adding multiple viewing tubes.

Some users were immediately surprised and interested to know that the approximate opposite side of the Earth from the device's location in Berkeley is in the Indian Ocean near Madagascar, confirming we can provoke wonderment. Many people assumed that we had created a database of images for the purpose of the prototype and explanation was necessary to make it clear the images were dynamically retrieved from Flickr based on geo-tags. Future areas of exploration might include other ways to communicate the locations revealed by the images and geo-tags to users. One tester suggested adding a physical globe that turns and shows your viewing location as an appropriate fit to the industrial and vintage form-factor of the TerraScope.

One user categorized the TerraScope as something that they could envision in a science museum. Others thought it would be useful as an educational tool or appropriate for tourist destinations. Rather than just seeing the "outside" of remote areas, one tester commented that the TerraScope would be a great exploration device for seeing inside locations not easily open for exploration like a museum, the universe, or even the human body. He said, "I like the idea of a porthole you can manipulate to see into something."

Conclusion

We present the TerraScope, a periscope-like device that allows a user to view images captured on the side of the Earth opposite from their current position in order to gain spatial perspective while experiencing photos in a tangible way. Our design team is optimistic that the TerraScope can provide an encouraging way for people to continue virtual exploration of new areas in a fun and engaging way. We describe the prototype that was constructed, including the physical form, the technical implementation, and the interaction design. Furthermore, we detailed the reaction of testers at the UC Berkley School of Information and identified design iterations for future exploration.

While the design team considered the initial showing of the TerraScope to be successful, there are future modifications and areas of exploration that can improve on the initial prototype. Features such as image zooming and filtering, ways to better communicate the origin of images, and a collaborative version of the TerraScope are some possible iterations.

Acknowledgments

We'd like to thank Kimiko Ryokai and Elizabeth Goodman for their support in conceptualizing the TerraScope, and Keng-hao Chang for his help in building the prototype.

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