The Madeira Touch: Encouraging Visual-Spatial Exploration using a Tactile Interactive Display

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Abstract
The current information marketplace for tourists is dominated by for-profit purveyors of information. Potential visitors must rely on experts-for-hire or search engine results in order to learn about a desired destination. In this paper, we introduce *The Madeira Touch*, a multimodal display installation rooted in the unique characteristics of Madeira, which allows users to explore the island by selecting a type of scenery and showing the user-generated photos of that type of scenery in a map-based interface. To make this pervasive display more engaging, we designed an exploratory tactile-input mode of interaction: users will be able to touch a physical object, representing a type of scenery (a rock for mountains, a seashell for the sea, etc.), which will then bring up suitable photos of that type of scenery overlaid on a map of the island. The display will help users to form their mental image of the island and to plan trips that best suit their interests.

Author Keywords
Pervasive display, tactile interaction, multimodal interaction, user-generated content, digital signage

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

Scenarios of Use

Scenario 1: While waiting at the tourism office, a visitor notices a display with boxes containing different objects surrounding it, in front of the entrance. She touches one object and notices the display showing images from a levada walk in Madeira. She removes her hand from the object and the display returns to the map of the island. She continues to touch the objects and see the images associated with them. She leaves the display with a better understanding of the opportunities on the island.

Scenario 2: A local Madeiran visits the tourism office to see the new interactive display. While interacting with it, he notices that one of the photos is an image he took on Instagram. He feels gratified that one of his images is contributing to the experience available on the display and to the information provided to tourists on the island.

Introduction & Motivation

In an increasingly connected world, travelers seeking local experiences may encounter a paradox. While it is easy to find information about destinations and places that they may wish to visit, it is also increasingly difficult to differentiate between the many options available. At the same time, travelers who have witnessed the homogenizing effects of globalization may place a particular premium on unique experiences that can only be found in certain places.

In this project, we took the island of Madeira as a representative case study of a well-known touristic destination that could be made more discoverable to the island's visitors. However, while tourists may choose to visit Madeira because of its beautiful scenery and outdoor activities, often related to the island's levadas, remote canals that serve as walking paths, they may not know what destinations on the island are best suited to the kinds of sceneries they hope to see. Currently, travelers who hope to experience natural beauty can plan their trips by either starting with a possible location and attempting to find correlating photos, or by beginning with photos of destinations they would like to visit and then attempting to find location information. Both approaches suffer breakdowns when photos are not tagged with the commonly-used location names.

In the field of pervasive display systems [4], we designed our solution to investigate how the use of an exploratory tactile mode of interaction to provide georeferenced visual information in the form of user-generated photos of points of interest (POIs) can facilitate visitors in discovering locations on the touristic destination, enhancing their experience. The result is *The Madeira Touch*, a pervasive display that allows users to correlate photos with locations, using a multimodal interaction that allow users to select either a type of scenery (touching a physical object) or a location (using the map-based visualization). Madeira represents an ideal place to develop a new way for visitors to explore the island, however, it is our intention for this system to be adaptable to other tourist destinations, levering on the location's unique offerings and characteristics.

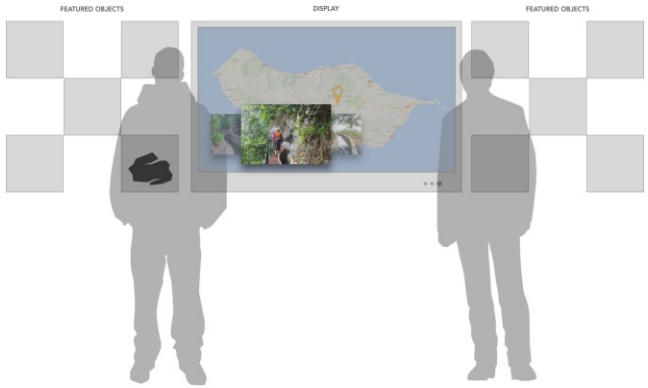

Figure 1: The Madeira Touch in context

The Madeira Touch

Our solution is to provide the Madeira's main tourism office, with our pervasive display. There, visitors to the island will be able to explore a map of Madeira using two modes of interaction: 1. traditional map-based touchscreen interaction (Figure 2), or 2. exploratory tactile-input interaction (Figure 3). With the first type of interaction, visitors will be able to touch the digital map and see user-generated photos of that location. With the second one, users will be able to touch a physical

Scenario 3: While his parents are in the queue, a 15-year-old notices a monitor surrounded by different natural objects in display boxes, in front of the entrance. He tries to touch a location on the monitor, expecting a touch-based interaction with the system. In response to his touch, the display shows a photo of that area. At the same time, a box lights up, grabbing his attention. He notices that the box holds a tree branch and that the photo on the screen is full of trees. Intrigued, he decides to touch the tree branch and the monitor begins to display photos of forests in different areas of the island. He touches another object, then another. When his parents are done, he brings them over to the display and together they explore the island.

object that corresponds to a type of scenery on the island, which will then bring up user-generated photos of that type of scenery (Figure 1). By enabling both forms of interaction, we intend to encourage exploratory scenery discovery as well as practical trip-planning in context in which multiple users, such as family groups, can co-experience the display [5].

Design Concepts

Traditional tourism information relies on professionally-produced content which is limited both in quantity and in coverage. We intend for this system to serve as an exploration of how UGC from social media can be curated to provide dynamic, updated and custom sets of information for specific audiences (i.e., visitors).

While interactive displays have a high potential to engage passersby, they frequently go unnoticed and unused [7, 11], confirming the so called 'display blindness' effect [8]. By situating our display in a strategic location (i.e., in front of the entrance) of a tourism office where visitors often wait to speak to someone, we intend to mitigate this issue, exposing visitors to the display at a time when they will be inclined to investigate. To further increase visitor engagement, we have incorporated a novel form of input in the form of physical objects that a user may touch to experience certain kinds of sceneries. In fact, studies of initial engagement with interactive displays have found that physical interactions prompt greater rates of *engagement among passersby* [6]. Moreover, our solution aims to overcome the 'interaction blindness' [10] that often plagues public displays by providing users with *novel and suggestive physical objects that encourage non-linear exploration*. This paradigm encourages a very different kind of interaction with the data, engendering an experience that is less goal-oriented and more exploratory. On the other hand, the use of tactile physical objects can raise the 'affordance blindness' issue, defined as the inability to understand the interaction modalities of a public display [3]. Our solution aims to moderate this problematic providing visual hints to attract the user's attention (as described in Scenario 3).

Figure 2: Users can touch the thumbnails on the screen.

Figure 3: Users can directly touch the physical objects.

Implementation

The Madeira Touch software architecture is composed of three main modules (as shown in Figure 4). *The Geotagged Photos Retrieval Module* collects geotagged photos and paths related to the main touristic georeferenced pedestrian walks that characterize the island. This stage, we have decided to use OpenStreetMap (OSM), an open source system that allows users to voluntarily collect and share GPS tracks and georeferenced data (i.e. Point of Interests). In

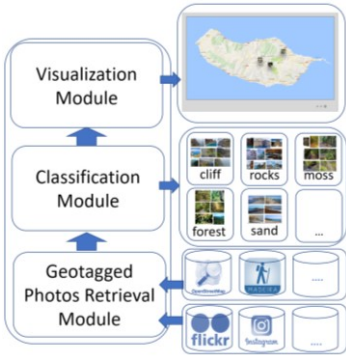

Figure 4: System architecture

Madeira, an island with an area of 802 km², the OSM dataset includes 16000 points and 24000 lines along with walking paths (levadas). There are also private datasets gathered by companies that have collected GPS tracks specifically related to walking paths such as Walk Me Madeira (http://www.walkmeguide.com/). Based on this dataset of GPS tracks and routes, the module retrieves public geotagged photos from different social media platforms and photo blogs to continually integrate UGC (i.e. photos) to enrich the user experience of our system [12]. At this stage, the system includes the Instagram and Flickr platforms, both of which provide developers with APIs for retrieving public photos based on locations and/or tags.

The Classification Module is the core of our system, because it enables (i) the elimination of photos which include faces and other non-nature showing images and (ii) the categorization of the collected pictures based on the main objects (rocks, sand, etc.) and scenery (cliff, forest, etc.) in each image. Each of these categories is correlated with a physical object with which the users can interact. Different kinds of machine learning algorithms have been developed for the recognition and classification of faces/landscapes/nature elements represented in photos from social media platforms and photo blogs [1, 2, 9, 13]. However, this system could also use a crowdsourcing approach to let participating users manually check the photos. A third approach would be a system like the Google ReCAPTCHA, which asks users to solve a puzzle by selecting all the images that represent a specific element.

The Visualization Module is the final step in this system and connects the categorized geotagged photos with the object the user touches, showing the information in a Google Maps based interface. Regarding the hardware requirements, *The Madeira Touch* utilizes a touch screen monitor and sensors to indicate when an object has been touched. Considering the design of our system, simple motion sensors should work well. The current design also uses LED lights in each box to emphasize the way in which each object corresponds to a certain type of photo. This way, even when the user is interacting directly with the touchscreen, the relevant object will light up, indicating the relationship between object and image.

Conclusion and Future Work

Our concept combines three characteristics in a unique way to make an engaging pervasive display for visitors to the island of Madeira. By using images from social media, the system insures that the content remains dynamic and accurate. By allowing users to explore the data, either by location or by scenery type, the system allows for scenery exploration and practical trip planning. Finally, by creating a tactile form of interaction, the system encourages users to consider the natural materials represented, allowing them to form a more sensual and complete mental picture of the destination. While all three of these characteristics are transferable and could be applied to other destinations, it is the authors' belief that, for future installations of this solution, the appeal and utility of such a system relies on its ability to accurately reflect the unique character of the local environment. To evaluate the effectiveness of our pervasive display in engaging users and enhancing their visiting experience, overcoming the display/interaction/affordance blindness issues, we plan to install the system in the Madeira's main tourism office.

References

1. Nuttapoom Amornpashara, Yutaka Arakawa, Morihiko Tamai and Keiichi Yasumoto. 2015. Landscape photo classification mechanism for context-aware photography support system, In *Proceedings of* Conference on Consumer Electronics (ICCE 2015), 663-666. http://doi.acm.org/10.1109/ICCE.2015.7066570
2. Pu Cheng and Jie Zhou. 2011. Automatic Season Classification of Outdoor Photos, In *Proceedings of* the Conference on Intelligent Human-Machine Systems and Cybernetics, 46-49. http://doi.acm.org/10.1109/IHMSC.2011.18
3. Jorgos Coenen, Sandy Claes, and Andrew Vande Moere. 2017. The concurrent use of touch and mid-air gestures or floor mat interaction on a public display. In *Proceedings of the Symposium on Pervasive Displays* (PerDis '17). Article 9, 9 pages. DOI: https://doi.org/10.1145/3078810.3078819
4. Nigel Davies, Sarah Clinch, and Florian Alt. 2014. Pervasive displays: understanding the future of digital signage. *Synthesis Lectures on Mobile and Pervasive Computing* 8.1 (2014): 1-128.
5. Jodi Forlizzi and Katja Battarbee. 2004. Understanding experience in interactive systems. In *Proceedings of the conference on Designing interactive systems: processes, practices, methods, and techniques* (DIS '04), 261-268. http://doi.acm.org/10.1145/1013115.1013152
6. Wendy Ju and David Sirkin. 2010. Animate objects: how physical motion encourages public interaction. In *Proceedings of the conference on Persuasive Technology* (PERSUASIVE'10), 40-51. http://doi.acm.org/10.1007/978-3-642-13226-1_6
7. Kazjon Grace, Rainer Wasinger, Christopher Ackad, Anthony Collins, Oliver Dawson, Richard Gluga, Judy Kay, and Martin Tomitsch. 2013. Conveying interactivity at an interactive public information display. In *Proceedings of* the Symposium on Pervasive Displays (PerDis '13), 19-24. http://doi.acm.org/10.1145/2491568.2491573
8. Jörg Müller, Dennis Wilmsmann, Juliane Exeler, Markus Buzeck, Albrecht Schmidt, Tim Jay, and Antonio Krüger. 2009. Display blindness: The effect of expectations on attention towards digital signage. *Pervasive Computing* (2009): 1-8. http://dx.doi.org/10.1007/978-3-642-01516-8
9. Mor Naaman, Susumu Harada, QianYing Wang, Hector Garcia-Molina, and Andreas Paepcke. 2004. Context data in geo-referenced digital photo collections. In *Proceedings of* the conference on Multimedia (MULTIMEDIA '04), 196-203. http://dx.doi.org/10.1145/1027527.1027573
10. Gonzalo Parra, Joris Klerkx, and Erik Duval. 2014. Understanding Engagement with Interactive Public Displays: an Awareness Campaign in the Wild. In *Proceedings of* the Symposium on Pervasive Displays (PerDis '14), 180-186. http://dx.doi.org/10.1145/2611009.2611020
11. Peter Peltonen, Esko Kurvinen, Antti Salovaara, Giulio Jacucci, Tommi Ilmonen, John Evans, Antti Oulasvirta, Petri Saarikko. 2008. It's mine, don't touch!: interactions at a large multi-touch display in a city centre. In *Proceedings of* the *Conference on Human Factors in Computing Systems* (CHI '08), 1285–1294. http://dx.doi.org/10.1145/1357054.1357255
12. Pavel Serdyukov, Vanessa Murdock, and Roelof van Zwol. 2009. Placing flickr photos on a map. In *Proceedings of* the conference on Research and development in information retrieval (SIGIR '09), 484-491. http://doi.acm.org/10.1145/1571941.1572025
13. Feng Tang, Daniel R. Tretter and Chris Willis. 2011. Event classification for personal photo collections. In *Proceedings of* Conference on Acoustics, Speech and Signal Processing (ICASSP), 877-880. http://doi.acm.org/10.1109/ICASSP.2011.5946544