A Mobile Guide to Explore Interconnections between Science, Art and Territory

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ABSTRACT

Most Cultural Heritage mobile guides are developed using a location-based hypertext model that guides the exploration of individual itineraries. However, Cultural Heritage places are often immersed in parallel and interlaced stories about art, history and science, which might be relevant to the tourist. Therefore, we are interested in investigating the semantic connections between the narratives that involve different Point of Interests to provide tourists with interconnected views of the Cultural Heritage of a place.

As a first step in this direction, we present the Triangolazioni mobile guide, which allows users to thematically explore places through the navigation of narratives, and to connect narratives to each other based on topic similarity. Triangolazioni can be accessed from mobile phone, tablet and desktop, and supports the physical and virtual exploration of Points of Interest in the area around Torino, Italy.

CCS CONCEPTS

• **Human-centered computing** → **Interaction techniques**; • **Information systems** → **Geographic information systems**; **Web searching and information discovery**.

KEYWORDS

mobile guides, Cultural Heritage

1 INTRODUCTION

We investigate semantic relatedness among stories, and the fusion of the physical and virtual dimensions of information presentation provided by the convergence of mobile guides with the internet, to support a flexible exploration of Cultural Heritage. The idea of interconnecting narratives emerged while designing a mobile app aimed at conveying different stories that link specific places of Torino city to the history of science, culture, and technology. At first, the narratives were supposed to be unrelated to each other:

- One such story dealt with the revolution of the system of units of measure in the XIX century.
- Another one dealt with the interactions between the fluvial ecosystem and the urban fabric.

A dam on the Po river, located in the center of the city, was chosen as the starting point for the second story. It turned out that the engineer who designed the dam in the XIX century, Ignazio Michelotti, also headed the committee of the Academy of Sciences of Torino that first addressed the introduction of the metric system in the Piedmont region of Italy, where Torino is located. This observation led to the idea that the appropriate medium should not merely provide a navigable list of contents related to an historical site, but rather motivate users to explore (virtually or physically, at their choice) a network linking sites, stories and personages, whose unexpected connections become the real thought-provoking message. Consequently, we decided to associate stories through heterogeneous types of hypertextual links, such as the co-occurrence of entities involved in the stories (e.g., places, historical people, objects that the stories have in common), but also semantic relations connecting different stories by means of common themes.

We envisage the management of interconnected narratives as follows: a story is based on the traversal of the semantic links

between the entities involved in it. However, while the user explores a story, (s)he can exploit a conjunction point with other stories to start "side walks", possibly going back to the former story at any point of time. In this way, the user can freely explore interlaced narratives, guided by the hypertext structure of the mobile guide.

To test these ideas, we developed the Triangolazioni mobile guide within the homonym project funded by the Public Engagement Lab of University of Torino. This project involves several research groups that are building stories concerning different aspects of the Cultural and Natural Heritage of Torino city and surroundings. So far, the stories planned to be included in the project deal with the historical development of the measure of space and time in every-day life; management, exploitation and socio-cultural significance of fluvial resources; the city community of scientists and engineers; innovations in chemistry and veterinary medicine; public health resources against plague outbreaks; urban agriculture; the electric motor and its use in public transportation. The present paper outlines the main features of the Triangolazioni app to show the type of navigation it supports.

In the following, Section 2 presents the related work. Section 3 describes the app and summarizes some experimental results. Section 4 outlines our future work and closes the paper.

2 RELATED WORK

Location-based hypertext [3, 10] is frequently used as a model for the development of tour guides that represent places, or the items of an exhibit, as hypertextual components to be browsed by the user, possibly taking her/his geo-location into account. For instance, GUIDE [7] presented the places visited in Lancaster city. INTRIGUE [1] suggested places to tourist groups in Torino city. Riot! [4] presented location-sensitive interactive plays to visitors in Bristol. More recently, PIL [14] advanced hypertext with multimedia content preparation and ubiquitous user modeling to personalize the visit and content presentation. Moreover, OnToMap [16] investigated the faceted exploration of information about Points of Interest. Furthermore, Braunhofer and Ricci extended mobile guides to take the user's context into account [5]. Other works pursue the personalization and advanced interaction interface for Cultural Heritage exploration [2, 8].

While we currently do not personalize the narrative to the individual user, we support the exploration of the interlacing between stories to enhance the user's understanding of the complex network of relations that link Cultural Heritage items. CHIP [19] applied semantic web technologies to enrich the presentation of items with information retrieved from public ontologies. We employ semantic relations to manage the hypertext underlying a specific story as well. However, we also use semantic similarity to retrieve stories that focus on similar topics.

3 THE MOBILE APP

3.1 Knowledge Representation

Triangolazioni is a web-based mobile guide and can be accessed from mobile phone, tablet and desktop to satisfy different usage contexts. It is based on an OWL [18] ontology, described in [15], where two types of relations connect entities within individual stories, and stories (narratives) through their common themes. This
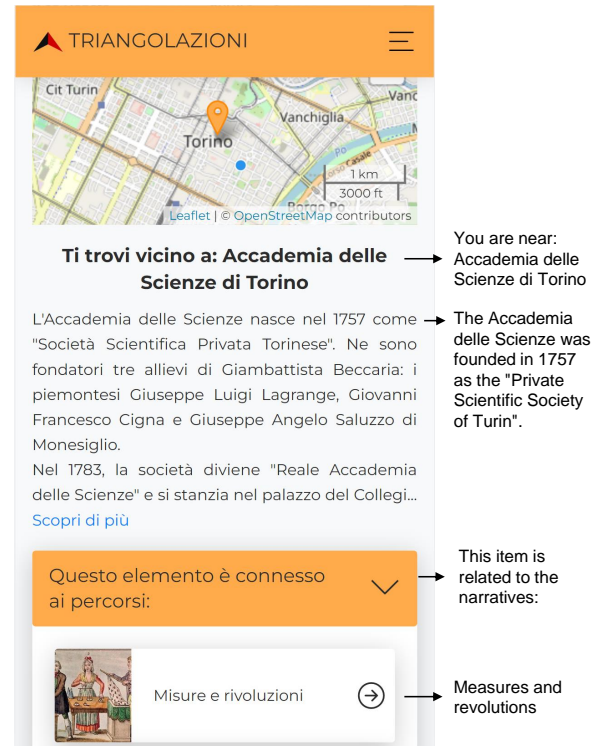

Figure 1: Visualization of the information about a Point of Interest when the user scans its QR code.

makes it possible to associate (i) entities, such as places, objects and people, within specific stories, and (ii) stories within clusters that have a common theme. The key element is an explicit representation of the "narrative" concept, which aggregates multiple entities, and of the "cluster of narratives", which groups stories.

The association of narratives in clusters supports side walking because it enables the user who is browsing a story to access, through hypertext links, other stories that are thematically related to the current one. Another possibility of side walking is given by the fact that Points of Interests can participate in multiple narratives. Therefore, from a specific place, the user can access the links to the other stories that pass through the place.

3.2 User Interface

We describe the narrative and thematic navigation of stories through a practical example. We assume that each Point of Interest to be presented by the guide is equipped with a QR code that the tourist can see while moving around. Moreover, the Points of Interest can be virtually visited by looking at a geographical map of the town, but we now consider the former scenario.

The user starts the interaction with the app by scanning a specific QR code on a Point of Interest. For instance, the one placed near the palace of the "Accademia delle Scienze", a historical building located in Torino city center. In turn, the mobile app shows an overview of the building (Figure 1) and its location in a geographical map. Moreover, the "This element is related to the narratives:" widget

(a) Visualisation of the PoIs of the narrative on the map, and short description introducing the story.

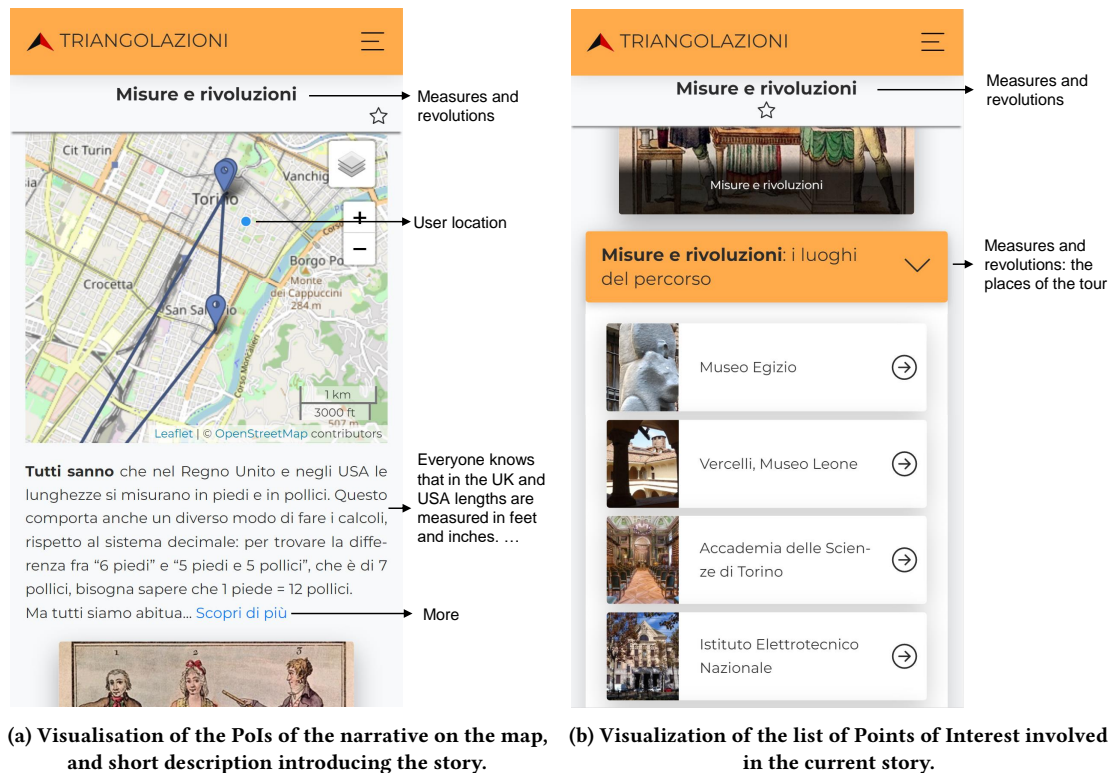(b) Visualization of the list of Points of Interest involved in the current story.

Figure 2: Presentation of the details of a narrative.

proposes a list of stories, each one involving the "Accademia delle Scienze" that the user can explore. In the figure, we only see "Misure e rivoluzioni" ("Measures and revolutions") because the place is not involved in any other narratives.

When the user selects a story, the app shows the introductory page (Figure 2a) with the itinerary, represented through blue lines connecting the places to be visited. The page also shows a text introducing the theme of the narrative and a set of pictures or a video related to it, so that the user can familiarize with the story and decide whether exploring it or not. Finally, as shown in Figure 2b, the page shows the "places of the tour" component that makes it possible to view the details of the other Points of Interest involved in the story, such as "Museo Egizio".

Let's suppose that the user continues the "Misure e rivoluzioni" tour by exploring in detail the Point of Interest named "Istituto Elettrotecnico Nazionale" (Figure 3a).

The page of a Point of Interest shows complete information about the place, that is, some images and a description framed within the selected story (narration-dependent information is associated to places to support their context-aware presentation). Moreover, the page provides links to geographical and historical data, objects located in the place, and people who have worked there. The user can explore further details of the place, and its external resources, such as web pages. See the orange widget in the lower portion of Figure 3a.

By scrolling down (Figure 3b), the user can either inspect the information to continue the current story, or start a new one. This is the connection point with the other narratives offering a broader view of the Cultural Heritage items related to what the user has inspected so far:

- "Other places of ..." enables the continuation of the current narrative.
- "Other suggested tours" supports side walking. Specifically, the user can access two types of stories:
  - The first list contains the other tours that involve the visualized Point of Interest. It supports an opportunistic exploration of Cultural Heritage that might involve moving around the town to reach nearby places, even though they are not part of the initially inspected story.
  - The second list enables the virtual visit to places that might be far away but are immersed in a narrative that is thematically related with the current story. Now, we manually define the clusters of thematically related stories. However, for this purpose, we plan to investigate the adoption of automatic topic extraction techniques, such as LSA [9]. In Figure 3b, the "Other suggested tours" widget is expanded and shows that "Istituto Elettrotecnico Nazionale" is also involved in "Misure e rivoluzioni" (co-located narrative). Moreover, it shows that "Misure e rivoluzioni", which the user is inspecting, is thematically connected to the "Misurare la Terra" story.

  The suggestion of thematically related narratives is coupled with the provision of a "video" and a description ("descrizione") link, which the user can click to overview

(a) Visualization of images and description of a PoI within story "Measures and revolutions".

(b) List of tours related to the PoI and the current narrative (side walking).
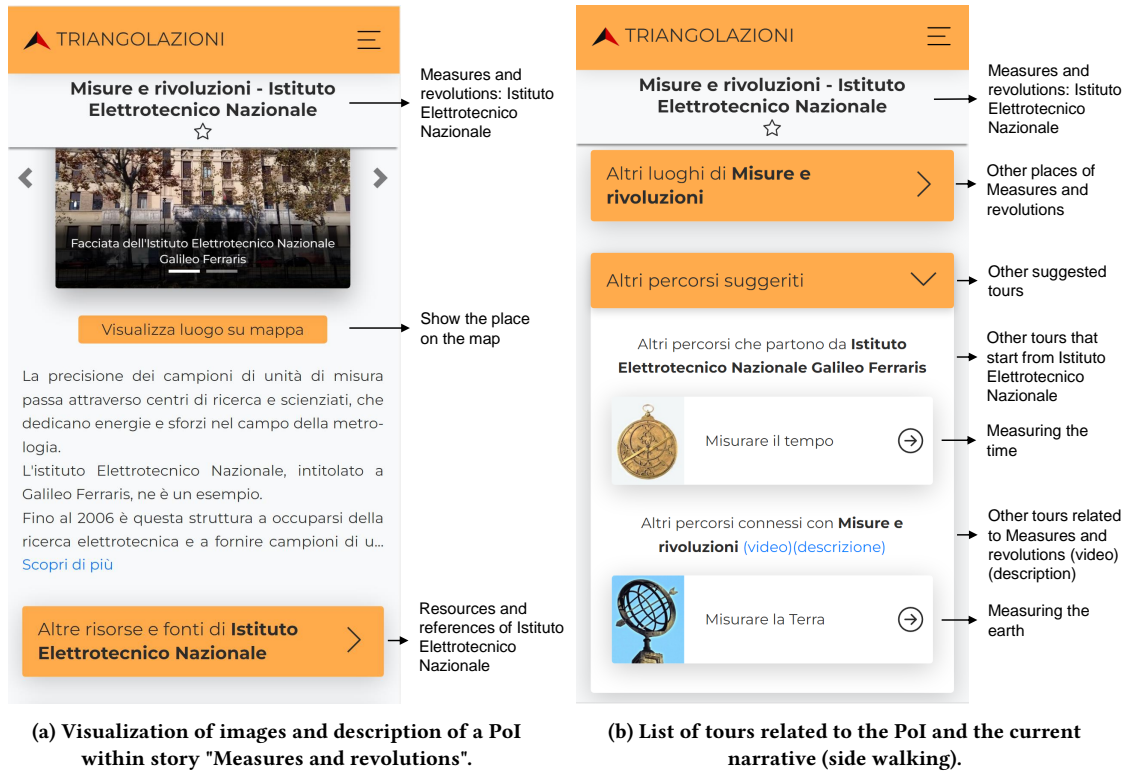
Figure 3: Details about "Istituto Elettrotecnico Nazionale" and possible side walks in other related stories.

the common theme of the narrations. This is important to enhance the understanding that stories are interlaced and the comprehension of the overall theme they are about.

By selecting one of the listed stories, the user can start a side tour that can be closed to go back to the initial tour by exploiting breadcrumbs (not shown in the Figures, see [15]). The user can explore the places of a narrative either by physically going there or virtually. Some narratives involve places that are far away from the user's location, but that are relevant to the completeness of the story.

3.3 User Experience

As described in detail [15], we carried out a preliminary user study with 25 participants to check the usability of Triangolazioni and the user experience with it. In that experiment, we focused on the perception of side walking that differs from the browsing experience offered by current mobile guides.

The results of the study show that the participants perceived the app as interesting and novel, and that the users who had never used a mobile guide before did not get lost with it. The usability analysis, carried out by exploiting the SUS questionnaire [6], confirmed that Triangolazioni has good usability and easy of use.

By grouping participants according to their motivation to seek out knowledge (Stretching component of the Curiosity and Exploration Inventory-II questionnaire, [11]), we discovered that the users having a high Stretching level appreciated the side walking functions offered by Triangolazioni more than the other ones. We

are thus interested in investigating the introduction in the app of personalization strategies to adapt the interactive functions to the individual user, as pursued in other works [12, 13, 17]. Another possibility is that of making the user interface configurable to switch on/off the side walking functions.

4 CONCLUSIONS AND FUTURE WORK

We described the Triangolazioni mobile guide, which demonstrates the presentation of interlacing relations among stories about Cultural Heritage places, people and objects. With respect to existing mobile guides, our app enables the user to explore stories based on a narrative model that supports the engagement in side walks concerning co-located stories, or thematically related ones. This is aimed at enhancing the user's understanding of the richness given by the network of connections among history, science and art stories that involve Cultural Heritage items.

In a user study we found that people perceived Triangolazioni as usable and they liked its storytelling capability. Moreover, the users who are more motivated to seek out knowledge appreciated the presentation of thematically related stories more than the other ones. This suggests to investigate the personalization of the user interface of the app in our future work.

In the future, we also plan to extend Triangolazioni with personalization features supporting the recommendation of CH items, and a user-adaptive management of the presentation of stories, e.g., to suggest topic-related stories on the basis of the user's interests, instead of applying a basic method to group stories we currently do.

From the technological viewpoint, we plan to exploit geo-fencing, in addition to QR codes, to identify the CH items near the user.

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