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# A Personalized Walk through the Museum: The CHIP Interactive Tour Guide

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**Abstract**

More and more museums aim at enhancing their visitors' museum experiences in a personalized, intensive and engaging way inside the museum. The CHIP<sup>1</sup> (Cultural Heritage Information Personalization) project offers various online and mobile tools to the users to be their own curators, e.g. browsing the online collections, planning personalized museum tours, getting recommendations about interesting artworks to see, and quickly finding their ways in the museum. In this paper we present the new version of the personalized museum guide<sup>2</sup> offered on a mobile device in the physical museum space. We maintain a dynamic user model to ensure high relevance of recommended artworks and museum tours and in this way (1) support personalized interaction both online and in the museum and (2) provide an intuitive bridge between the online and on-site experiences. We apply semantic Web technologies to enrich the museum collection and guarantee serendipity, novelty and relevance of the recommendations.

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<sup>1</sup> <http://chip-project.org>

<sup>2</sup> <http://www.chip-project.org/demo/mobileguide/>

## **Keywords**

Interactive museum tours, mobile museum guide, semantic web, recommender systems, user modeling

## **ACM Classification Keywords**

H5.m. Information interfaces and presentation

## **Introduction**

The CHIP (Cultural heritage Information Presentation) project is a cross-disciplinary research project, combining aspects from cultural heritage and information technologies. The team has been working at the Rijksmuseum Amsterdam since early 2005, as part of the CATCH (Continuous Access to Cultural Heritage) program. We explore interactive and engaging ways to (i) acquire visitors' interests of the museum collection, (ii) to personalized museum services on the Web site and in the real museum space, as well as (iii) to link visitors' experiences online and in the museum. In this context, we follow a user-centered approach to develop a set of technical solutions for semantically enriching the Rijksmuseum digital collection and for interactive distributed user modeling used for content-based recommendation techniques. We have performed a series of empirical user studies [1,2,3] to derive requirements for building the tools and to access the quality of the personalization provided by them. In this paper, we focus on describing the design and development of a mobile museum guide providing a personalized navigation to museum visitors. For description of the other CHIP tools see [4].

## **Personalized Museum Guides**

We have identified four types of museum tours: (i) human-guided tours, (ii) audio tours, (iii) online/virtual tours, and (iv) multimedia tours [5]. In recent years,

mobile technology provides various opportunities for multimedia tours to help visitors to enhance the museum experiences [6]. Personalization in museum guides could enable visitors to achieve more enjoyment as well as greater knowledge and excitement during the tour [7], e.g. for example the MIT Media Lab audio and visual narration adapting to the user's interest acquired from the physical path in the museum and length of the user stops [8]; or the PEACH PDA-based location-aware museum tour [9] adapting the museum content to the visitor's interests and location. Further, the INTRIGUE guide recommends sightseeing destinations by taking into account the preferences of heterogeneous tourist groups [10]. In CHIP we personalize the selection of artworks for the museum visitor based on (1) their underlying semantic relations, e.g. related styles, artists, themes, or locations and (2) the strength of the user interest in those semantically enriched properties. We identify a number of recommendation patterns, which prove to deliver most relevant and serendipitous suggestions for artworks to the users.

Linking the visitor's experiences online and on-site into one cycle supports a continuous learning experience, helps retaining memories over time, enables to pursue individual interests, and allows the visitor to focus on experimentation, discovery and the aesthetic experience during a museum visit. Several museums, e.g. Tate Modern, Science Museum Boston, already explored the potential of bridging the Web and the physical museum spaces. However, the bottleneck appears to be in the actual combining of the user data from both spaces. All CHIP tools use a common distributed user model, which is continuously updated with the ongoing user interactions both on the Web and the mobile platforms.

## Usage Scenario

Imagine the following usage scenario: *Before a museum visit, based on the recommendations provided by the CHIP Artwork Recommender, our user creates online a tour of Rijksmuseum artworks that match her art interests and are currently available in the museum. In the museum, with the help of the CHIP mobile guide, our user can follow the same tour she created online. During the visit, the tour is dynamically adapted with related artworks to the explicit interests and preferences the user indicates. The navigation path, the length of the tour and the number of offered artworks are also adapted accordingly. During the visit, the mobile guide interactions are dynamically synchronized with the user profiles maintained on the CHIP website.*

## CHIP Personalization Tools

To support this usage scenario we have developed three tools: Online Art Recommender, Online Tour Wizard (online demo at: <http://chip-project.org/demo>) and Mobile Museum Guide (demo: <http://chip-project.org/demo/mobileguide>).

- The online Art Recommender (fig. 1) helps users to discover their art interests in the museum collection and to store them in a corresponding user profile.
- The online Tour Wizard generates online museum tours (presented on a museum map in fig. 2 and in a historical timeline in fig. 3) containing recommended artworks according to the user's interests.



**figure 1.** CHIP online Art Recommender. The interface contains four main interaction parts: (top left) artworks sequence, (top right) rated topics, (bottom left) recommended artworks, and (bottom right) recommended topics (<http://chip-project.org/demo/>).



**figure 2.** CHIP online Tour Wizard (map). The interface contains two main interaction parts: (left) two floors of the museum map, (right) list of tours for the user (including all artworks in each tour). Indicating an artwork in the tour list locates its position on the floor maps and the other way

around, indicating a thumbnail of an artwork on the map highlights in the list of tours (<http://chip-project.org/demo/>).

- The mobile Museum Guide offers the tours created online, provides extensive description of each artwork, as well as a set of related artworks to the ones included in the tour or any given one in the museum. The users can dynamically adapt their tours by expressing in terms of ratings preferences in some seen artworks, or by indicating a desired tour length or number of artworks to be included in the tour.



**figure 3.** CHIP online Tour Wizard (timeline). The interface contains two main interaction parts: (left) timeline with thumbnails of the artworks in the tour, (right) list of tours for the user (including all artworks in each tour). Indicating an artwork in the tour list locates its position on the timeline and the other way around, indicating a thumbnail of an artwork on the timeline highlights in the list of tours (<http://chip-project.org/demo/>).

## CHIP Architecture

Figure 5 depicts the client-server architecture with Java Servlets running on the CHIP server, described elsewhere in details [15, 16]. The collection data refers to the enriched museum collections, currently the Rijksmuseum ARIA database, maintained in a Sesame Open RDF memory store and queried with SeRQL. The user data contains OWL user models and tour data. The Web-based demo components are realized as Java Servlets and JSP pages with CSS and JavaScript. The mobile guide is implemented as a Web application running via a Web browser on different mobile devices (e.g. smart phones, iPhone, iPod)



**figure 4.** CHIP mobile Museum Guide, (from left to right): (a) tour selection and configuration screen; (b) tour sequence; (c) related artworks. An online demo is available at: <http://www.chip-project.org/demo/mobileguide/>

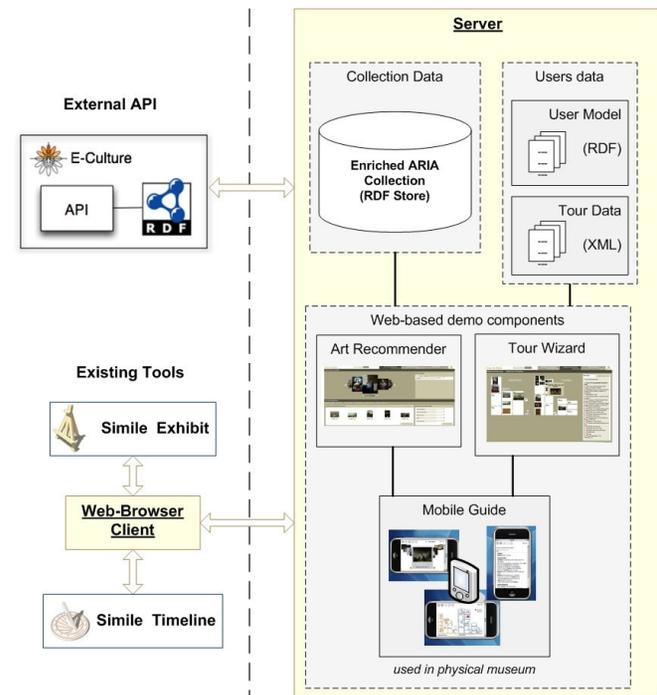
## Mobile Museum Guide

An important aspect of the mobile museum guide is the various types of adaptation we can provide to cater different context and user aspects (e.g. location,

temporal preferences, art interests). Typically we perform three main actions for realizing these adaptive steps: (1) filter out from the tour artworks that do not satisfy the current constraints; (2) add artworks to the tour that qualify according to contextual and user criteria; (3) re-order artworks in an optimal navigation sequence (e.g. to fit the room configuration and user position). The contextual and user constraints we collect both implicitly (e.g. monitoring user position and time spent per artwork) and explicitly (e.g. user ratings, indicate the maximum number of artworks the user wants to see in a tour or the maximum amount of time the user wants to spend in the museum). We identify two levels of adaptation when following a tour and when configuring a tour.

At a *tour configuration level* we can: (1) adapt the number of artworks to see in a tour based on the maximum length of the tour (in minutes) explicitly given by the user. Similarly, we also can (2) adapt the time to be spent in a tour based on the maximum number of paintings the user is interested to see in one tour. The user can change those adaptation parameters at any point during the usage of the mobile guide (e.g. before starting a tour, while following a tour). Additionally, at this level, any predefined Rijksmuseum tour could be adapted to the art interests stored in the individual user profiles. This adaptation could also be applied on tours shared with friends. For example, one user can adapt to the own interests a tour that a friend has shared with him; or a tour shared between two friends can be adapted to match their both profiles together. In other words, this means either (1) including in the tour only artworks that are liked by both users (above a certain threshold), or (2) making detours of the tour for each user and include meeting

points. This would allow them to follow the same tour together in a museum and still see items, which fit their individual differences.



**figure 5.** CHIP Architecture.

At the *level of following the tour* adaptation is possible when the user indicates interest in a given artwork. In this case, a set of related artworks are offered, and potentially included in the tour. This would result in adding the selected artworks to the tour, re-ordering the current tour to fit the new spatial constraints and filtering out artworks in order to meet temporal or

number restrictions given by the user at a configuration level. The artworks in each tour are ranked according to their level of interest to the user. To *find related artworks* we use semantic relations between them, e.g. semantic relations between their properties. For examples, related artworks to a self-portrait of Rembrandt would be other portraits and self-portraits and male portraits by Rembrandt, male portraits by students of Rembrandt, male portraits or self-portraits by other artists in the same style.

### **Discussion and Future Work**

Following a user-centered design method, we have performed a number of user studies [1,2] to test the effectiveness of the recommendations and the overall usability of the Art Recommender. The results proved that the system helps users, especially novice users, to quickly elicit their art interests in the museum collection and it recommends artworks suiting different user's preferences. Based on these initial results as a next step, we plan to test the usability and efficiency of the Tour Wizard and Mobile Museum Guide with real visitors in a constructed museum scenario.

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### **References**

- [1] Wang, Y., L. Aroyo, N. Stash, and L. Rutledge. 2007. *Interactive User Modeling for Personalized Access to Museum Collections: The Rijksmuseum Case Study*. Proc. of the User Modeling conference (UM'07).
- [2] Wang, Y., N. Stash, L. Aroyo, P. Gorgels, L. Rutledge, and G. Schreiber. 2008. *Recommendations*

*Based on Semantically-enriched Museum Collections*.

JWS: Semantic Web Challenge 6 (4): 43-50.

[3] H. Cramer, V. Evers, S. Ramlal, M. van Someren, L. Rutledge, N. Stash, L. Aroyo and B. Wielinga: *The Effects of Transparency on Trust in and Acceptance of a Content-based Art Recommender*. UMUAI 18:5, 2008.

[4] Aroyo, L., N. Stash, Y. Wang, Gorgels P., and L. Rutledge. 2007. *CHIP Demonstrator: Semantics driven Recommendations and Museum Tour Generation*. Proc. of the Int. Semantic Web Conference (ISWC'07).

[5] Wang, Y., R. van Sambeek, Y. Schuurmans, L. Aroyo, N. Stash, L. Rutledge, and P. Gorgels. 2008. *Be Your Own Curator with the CHIP Tour Wizard*. Proc. of Museums and the Web (MW'08).

[6] Anderson, Paul, and Adam Blackwood. 2004. *Mobile and PDA technologies and their future use in education*. Proc. of JISC Technology and Standards Watch.

[7] Bowen, J. P., and S. Filippini-Fantoni. 2004. *Personalization and the web from a museum perspective*. Proc. of Museums and the Web conference

[8] Sparacino, Flavia. 2002. *The Museum Wearable*. Proc. of Museums and the Web (MW'02).

[9] Rocchi, C., O. Stock, M. Zancanaro, M. Kruppa, and A. Kruger. 2004. *The Museum Visit: Generating Seamless Personalized Presentations on Multiple Devices*. Proc. of IUI'04

[10] Ardissono, Goy, Petrone, Segnan, Torasso. 2003. *INTRIGUE: Personalized recommendation of tourist attractions for desktop and handset devices*. Journal of Applied Artificial Intelligence 17 (8): 687-714.