

CHIP Demonstrator: Semantics-driven Recommendations and Museum Tour Generation

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1 Introduction

The main objective of the CHIP project is to demonstrate how semantic-web technologies can be deployed to provide personalized access to digital museum collections. We illustrate our approach with the digital databased ARIA of the Rijksmuseum Amsterdam⁴. For the semantic enrichment of the Rijksmuseum ARIA database we collaborated with CATCH STITCH project⁵ to produce mappings to Iconclass⁶, and with the MultimediaN E-culture project⁷ to produce the RDF/OWL of the ARIA database. CHIP main focus is on exploring the potential of applying adaptation techniques to provide personalized experience for the museum visitors both on the Web site and in the museum. This resulted in three demonstrator components:

- Artwork Recommender - a Web-based rating dialog to build a user profile, based on semantics-driven recommendations
- Tour Wizard - a Web-based tool using the user profile to generate automatically personalization museum tour for each user, and (semi)-automatically generate various personalized routes through the digital Rijksmuseum collection.
- Mobile Tour - a PDA-based tool, which uses the results from the Tour Wizard and helps user navigate and discover artworks in the physical Rijksmuseum environment.

The online version of the CHIP demonstrator can be found at: <http://www.chip-project.org/demo/>. A tutorial with a brief walk-through of the personalization functionality can be found at: <http://www.chip-project.org:8091/demo/walkthrough/walkthrough.jsp>.

Further, we give a short introduction to the basic functionality of the Web-based parts of the CHIP demonstrator. Please note that the CHIP project collects feedback, on the functionality and usability of the demonstrator, on a

⁴ <http://rijksmuseum.nl/aria/>

⁵ <http://www.cs.vu.nl/STITCH/>

⁶ <http://www.iconclass.nl/libertas/ic?style=index.xsl>

⁷ <http://e-culture.multimedien.nl/>

regular basis from studies with museum visitors. Thus, the demonstrator changes over time as we are incorporating more functionalities and improvements to the interface.

2 Usage Scenario: You Rate - We Recommend

In 1 we illustrates how we employ semantics in building user profiles and using them for generating recommendations to the user, as a way of guiding users through the museum collection. In the *Artwork Recommender*, the user rates an artwork and several properties:

- artwork *Night Watch* - 4 stars (i.e. ‘‘I like *Night Watch*’’);
- creator property *Rembrandt* - 4 stars (i.e. ‘‘I like *Rembrandt*’’);
- theme property *Landscape* - 4 stars (i.e. ‘‘I like *landscape*’’);
- theme property *Self-portrait* - 1 star (i.e. ‘‘I hate *self-portrait*’’).

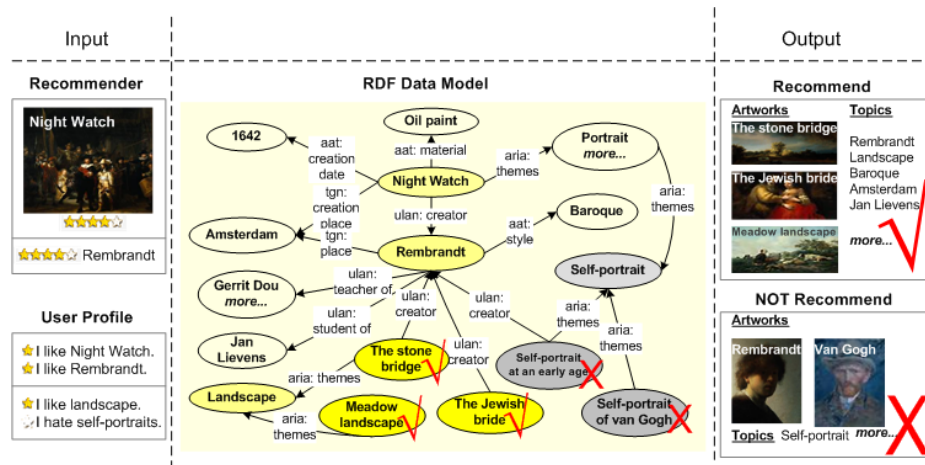


Fig. 1. Exploring semantic links in the Rijksmuseum Amsterdam collection

The User Profile stores the user’s ratings for generating recommendations. Now, let’s see how does the artwork and topic recommendation in CHIP works:

- Find all ‘‘*Night Watch*’’-related properties, e.g. creator, creation place, creation year, material and themes
- Find all ‘‘*Rembrandt*’’-related properties, e.g. style, teacher-of and student-of.
- Find all artworks with these properties, e.g. ‘‘*The Jewish Bride*’’ and ‘‘*The Stone Bridge*’’ by *Rembrandt*

- Include all artworks with property "Landscape", e.g. "The Stone Bridge" and "Meadow Landscape"
- Exclude all artworks with property "Self-portrait", e.g. "Self-portrait of van Gogh" and "Self-portrait at an early age"

This results in two sets of recommendations:

- Result: recommend all artworks with the above positively rated properties. All recommended artworks are ordered by the number of matching properties, e.g. "The Stone Bridge" is the first one because it has both "Rembrandt" and "landscape".
- Result: recommend all topics with the above positively rated properties, e.g. "Rembrandt", "Landscape" and "Baroque"

Two more usage scenarios are given in the online tutorial.

3 CHIP Architecture

The demo is based on a Sesame[1] RDF store with SeRQL-based access to user modeling, recommendation and tour generation components. The tour generation component consists of two main parts: (1) semantic-search facility for the user to search for themes or topics of a possible tour (e.g. Search for Rembrandt will result in sub-set of Rembrandt artworks, which are of interest to this user according to her user profile); and (2) my tours visualization on a historical timeline, museum map or as a list of artworks. In the later the user can also manually create a tour by giving it a name than continuing with the search option to find single artworks to include in the currently created tour holder. In 2 we show the current CHIP architecture and its sub-components.

3.1 Rijksmuseum Amsterdam Collection and Shared Vocabularies

Currently, the demonstrator hosts four thesauri, namely the three Getty vocabularies⁸, i.e., the Art and Architecture Thesaurus (AAT), Union List of Artists Names (ULAN) and the Thesaurus of Geographical Names (TGN), as well as the subject classification Iconclass⁹. We use mappings to IconClass provided by STITCH project [?]. We use the Getty thesauri conversion from their original XML format into an RDF/OWL representation done by MultimediaN E-culture project[2, ?]. The Getty thesauri are licensed¹⁰. Following this approach we use mappings of ARIA terminology to the AAT, ULAN, TGN and IconClass concepts. For example, the concepts for places in ARIA refer to location terms in TGN; styles in AAT are linked to artists in ULAN; birth places of artists in

⁸ http://www.getty.edu/research/conducting_research/vocabularies

⁹ <http://www.iconclass.nl/libertas/ic?style=index.xml>

¹⁰ The partners in the project have acquired licenses for the thesauri. People using the demonstrator do not have access to the full thesauri sources, but can use them to annotate and/or search the collections.

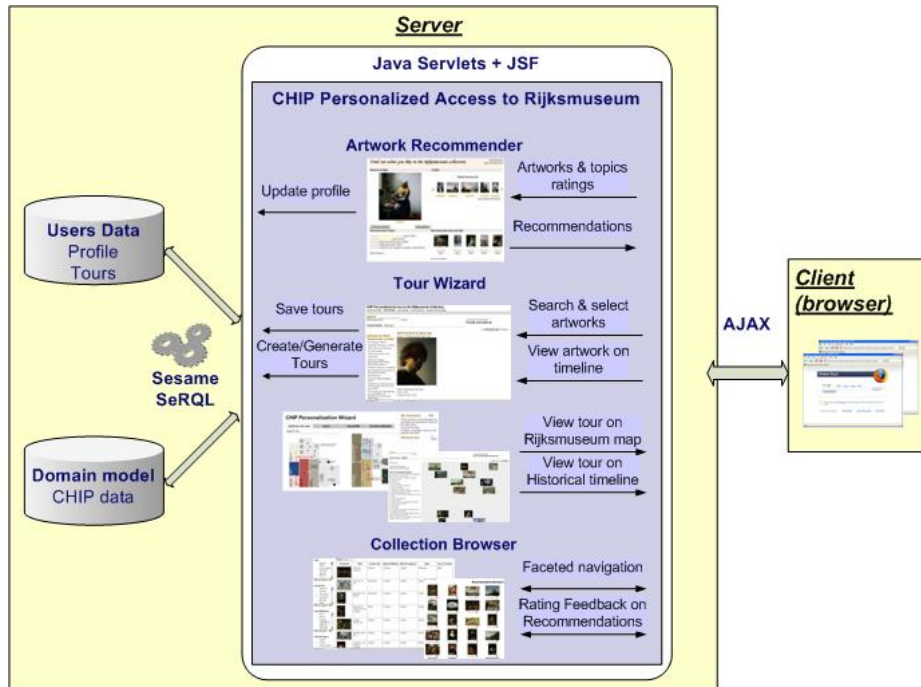


Fig. 2. CHIP Demonstrator Architecture

ULAN refer to location terms in TGN; subject themes in ARIA refer to subjects in IconClass; names of artists in ARIA refer to ULAN artists, etc. See 3. We use the official ARIA collection of the Rijksmuseum in Amsterdam containing images of some 750 master pieces maintained at the Rijksmuseum Amsterdam website. However, we are now preparing for a migration to the main Oracle database of about 70,000 objects, extending the current RDF/OWL with not only artworks but also shop, news and user comments items. The current client interface is developed in HTML+CSS and Ajax[3].

4 Build Your Profile with Artwork Recommender

The user can start its exploration with first building a user profile in the Artwork Recommender component. This is driven by a rating dialog[4] for artworks from the Rijksmuseum Amnsterdam collection. The user can express her opinion using five stars, where the meaning of each star is shown when you hover the cursor over it. Note that a rating of three stars means *Not interested in*. You can continue the process of rating artworks as long as you are satisfied with the state of your user profile shown on the right, or as long as you find appropriate the set of recommended artworks shown in the lower right part of the screen. You can skip rating artworks by pressing "Next artwork" button. There is no avarage number

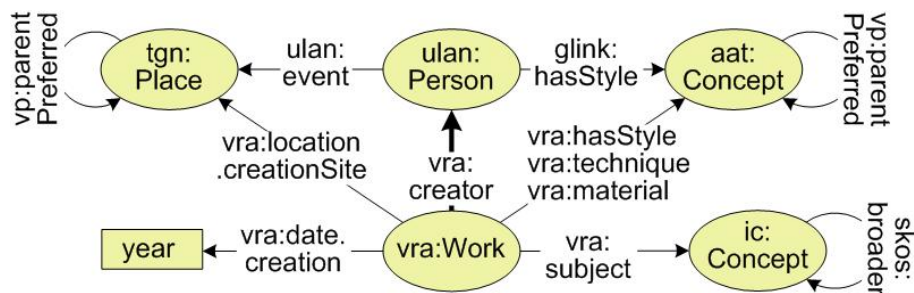


Fig. 3. CHIP Data Model and Vocabularies

of artworks the user needs to rate. Important is to kick off the recommendations you need to give at least one positive (4 or 5 stars) rating. The system would not be able to recommend artworks and topics based only on negative (1 or 2 stars) ratings, or on "not interested in" (3 stars).

Important here is that we recommend not only artworks but also topics (based on the semantic description of each artwork you have already rated). You can provide your positive or negative feedback to each recommendation (both topics and artworks) by rating the empty set of stars associated with it. This would be recorded then in the user profile in order to increase the level of certainty for related properties and artworks.

If you have logged with your FOAF profile you could also choose the option to view your full profile (right top) and see your personal and social network data. In the full profile we also store the history interaction data about tours you have created and/or followed both on the Web and in the museum with the PDA-based mobile tour. Current investigations focus on including also social filtering[5] in order to include social aspects in recommendation and to optimize specific cold-start problems.

In this interactive way[6]the user has the opportunity to quickly get a feeling of the Rijksmuseum collection and give her opinion on the paintings presented to her. Based on a user rating the system finds artworks from the Rijksmuseum collection that are the most probable candidates for this user to like.

5 Create and Personalized Your Tours with Tour Wizard

The main rationale behind the CHIP demonstrator is based on the assumption that users more and more will spend time repairing their visits to museums and also reflecting on them after the visit. This is driven by the observation that users have increasing choice of digitalized collections and related information. This leads us to our main goal to allow the **users to be their own curators**, e.g. selecting the artworks they want to see, influencing the order, the overall theme of the tour and the time to be spent in the museum. In order to realize this we maintain a common user profile for the user on the Web and on the

mobile device, and in this way we keep track of users interaction history both in the virtual and in the physical museum. See 4.

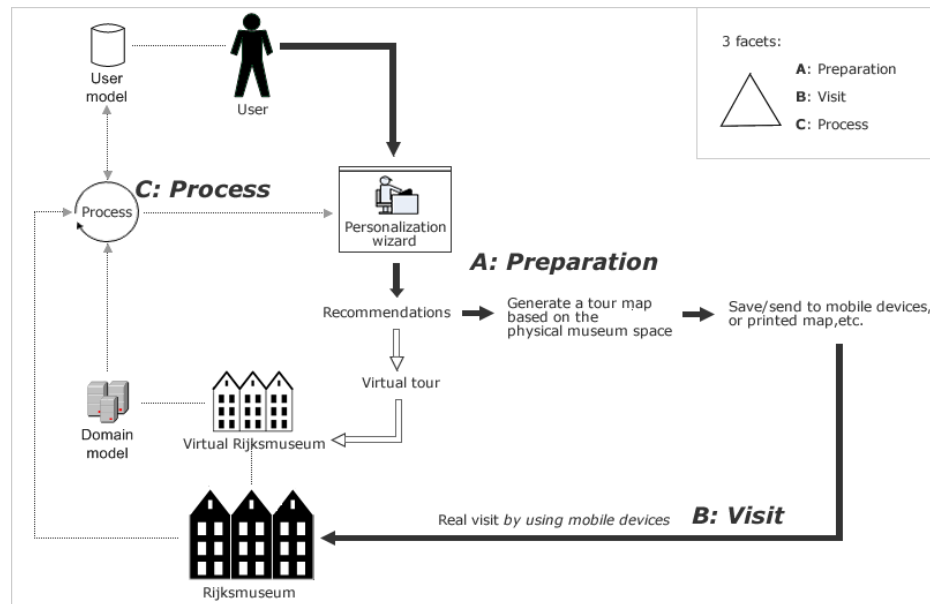


Fig. 4. CHIP Personalized Access Rationale

In the Tour Wizard you have two main screens (tabs):

- **My Tours:** Here you can see an overview of the current tours and you can create a new tour if desired. You can (1)select a tour and then (2)search for a topic, artist or an artwork to include further new items in the currently selected tour. **Note** that if you go straight to the search option you will not be able to add new items to yours; you will be able to only search for topics, artworks or artists and browse through the search results. Among the already existing tours we generate for your a **Tour of Recommended Artworks**, which contains 20 Riksmuseum master pieces selected according to your current user profile. If you interact with the demo and alter your user profile, this list will be updated as well. You can **view** the list both at the **Museum Map** or on a **Historical Timeline**.
- **Search Results:** Here you can search the Rijksmuseum collection for topics, artists, locations, styles, artworks, etc. and browse the search results. Ideally these results will be altered (filtered with) according to your user profile, so that you will see the artworks related to your search query, which are of relevance and interest to you. However this option is still in work-in-progress, so it might not work properly yet. **Note** that if you first do search and then while browsing the results you want to add some of them to an existing tour,

you will not be able to do so. Unfortunately, the current interface implementation restricts you to **first select a tour and then to perform search for artworks to be included in this tour**. We are working on improving this interface limitation, so that you are able to add at any point of time an artwork from the search result (or even from your Artwork Recommender interface) to an existing tour.

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