PERSONALIZED PRESENTATION AND NAVIGATION
OF CULTURAL HERITAGE CONTENT

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ABSTRACT

The goal of the CHIP (Cultural Heritage Information Personalization) project is to provide personalized access to combined cultural heritage content. The driving case is given by the Rijksmuseum content presented on the museum web site and visitor guides. The CHIP project aims to extend and integrate existing technologies for semantic browsing and search (e.g. Topia[1][1], Noadster[2], OntoAIMS), ontology-based user modeling (e.g. OWL-OLM[2][3]), adaptation strategies (e.g. AHA![3][4]) and presentation of structured information (e.g. Hera[4][5]) in order to achieve its goals. We use as a starting point the Topia demonstrator, which provides search and browsing interface to 1250 semantically described Rijksmuseum artifacts. We extend further this research by involving semantic-aware adaptation strategies and semantic based reasoning user model elicitation to allow for effective personalization of the content navigation and presentation on various devices (e.g. web application, PDA, etc.). In this we integrate artifacts and background information that span over several collections and sources. Adaptive clustering mechanisms show the relations between art objects and links to background information, based on their metadata. Further, hypermedia formats support multi-branched story lines connecting art objects in "precooked" or automatically generated ways.

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[1] http://portal.demo.telin.nl/topia/query
[2] http://wwwis.win.tue.nl:8085/staims/
[3] http://aha.win.tue.nl/
[4] http://wwwis.win.tue.nl/~hera/

1. MOTIVATION

A rapid expansion is observed of the already extremely large amount of digital multimedia content and services. It becomes really crucial to (1) support a quick and easy access to multimedia collections, (2) allow for automatic generation of personalized and well-structured presentations of multimedia objects, (3) provide adaptive navigation across digital collections and objects, and (4) accommodate various visualization strategies in order to facilitate good overview of the entire collection, easy traceability of the individual objects and comprehension of the relations between the objects.

The automatic and structured composition of multimedia presentations has long been a core premise of multimedia research. However, most related research on semantics for media indexing and automated information retrieval deals mainly with the access to individual media objects and does not focus on the informative relational structure. In our research we aim at automatic retrieval of both content and structure upon request in order to enable effective support of the user while navigating and browsing of multimedia search results. We use semantics in order to dynamically cluster the individual objects and show the relations between the clusters (Figure 2, Aduna ClusterMap Visualization in Topia).

The user's preferences, characteristics and other aspects play an important role in the composition of personalized multimedia presentations. Taking this into account allows for tailoring the multimedia presentation not just to the intrinsic features of the digital collections (e.g. relations, metadata). The user-modeling community deals with methods for gaining understanding of the users, in terms of user models and profiles, and uses that

understanding to tailor the system's behavior to the needs of the individuals. In this user modeling, typically only one or just a few user aspects are modeled. Moreover, the modeling is performed under a closed world assumption. With the shift to the Semantic Web, the applications need to take into account user viewpoints ranging from domain experts to complete novices, and to provide user modeling approaches which are able to deal with the dynamics of a user's conceptualization and the openness of the Semantic Web. Our research aims at maximizing the automation of the acquisition of user knowledge, thus providing an effective solution for multi-facet user modeling. We enable reasoning on explicit user semantics to support interoperability of applications with respect to the user data and thus to achieve seamless adaptation and personalization across devices and applications.

Finally, in order to ensure sufficient usability and scalability of multimedia presentations of large amounts of digital content, we investigate visualization techniques (see Figure 1 and 2) able to give various views over the collection, the individual objects, and the range of characteristics (e.g. relations, descriptive information, semantics).

For the research theme on '*personalisation of cultural heritage content*', the CHIP project aims at acquiring new knowledge in three sub-domains: (1) gathering of information, (2) adaptation and personalization, and (3) automatic generation of presentations. The goal is to go beyond existing state-of-the-art in multimedia presentation by automating the process of gathering of user and context data, excelling in the accuracy when analyzing and reasoning with this data in order to produce effective personalization. Furthermore, we aim at using this as an input, next to the collections' explicit semantics, for the generation of navigable structures that (1) orient the user in the current local context, (2) communicate the overall structure from this perspective and (3) provide navigation through it while maintaining a sense of orientation in the info. As a driving use case for this research we use the current content management architecture of the Rijksmuseum and extend it by providing techniques to define and maintain explicit semantics (e.g. annotation and reasoning), by integrating a semantic-driven user modeling approach in the process of retrieving, presenting and navigating multimedia objects, and by employing advanced visualization techniques to deal with collection dynamics.

In a previous research, a conceptual RDF repository was created – a conversion of the ARIA (Amsterdam Rijksmuseum InterActief) database to RDF. ARIA includes about 1250 artifacts from the museum, associating them not just with images but also with concepts such as description, genres, detail and artists.
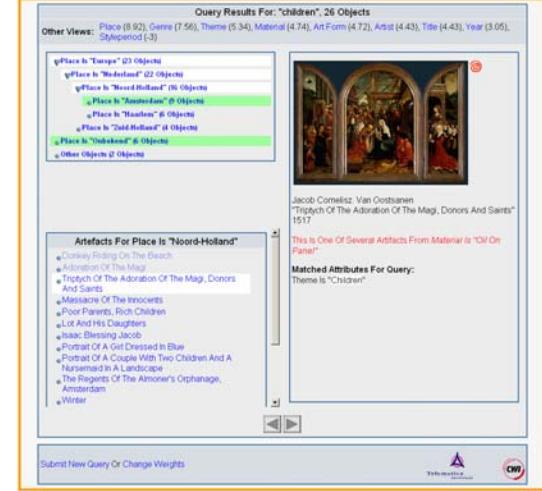
Figure 1. Topia: Text-based search results presentation
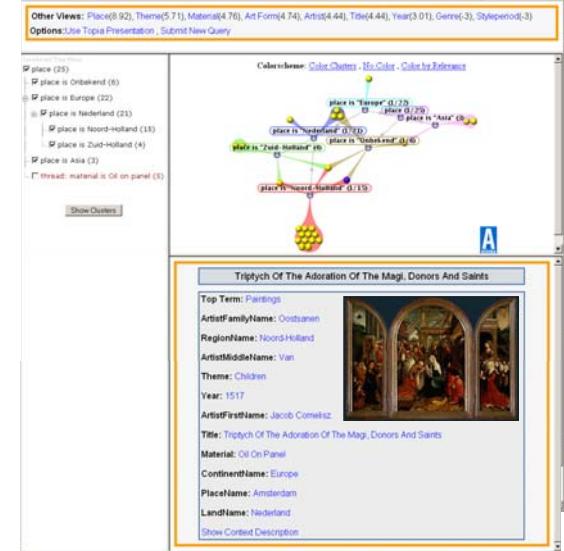
Figure 2. Topia: Search results presentation with Aduna ClusterMap Visualization[5]

2. STRUCTURE AND COHERENCY IN MULTIMEDIA COLLECTIONS

Cultural collections do not consist of a discrete database of art objects. They come with a story that connects different art objects, details of objects, and background information together. The CHIP project aims to present art objects by organizing them in groups, and more generally showing the relations between art objects, based on the objects metadata, and indirectly on their links with background information. Hypermedia formats will be used to allow multi-branched story lines that can connect art objects in "precooked" or automatically generated ways. In this way, CHIP mainly deals with the problem of

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[5] http://wwwis.win.tue.nl:8082/clustermap/index.html

presenting cultural information in all its diversity. In particular we concentrate on the following issues:

- *Semantic integration:* A side-effect of the virtual integration of different databases is that different information is available for different objects (because they come from differently structured databases). Experience from the Topia project shows that such structural differences are easier to handle when the used information model is closely related to the semantics, rather than using the data model of the underlying collection. Existing approaches for presenting structured information (e.g. Hera project) will be extended to cover the generation of presentations of information objects of differing structure.

- *Uniformity in the content:* Another challenge is to find a balance in showing the particularities of the specific collection and allow for traceability of the individual artifacts coming from various collections with a reference to the source or owner of the information.

3. NAVIGATION IN MULTIMEDIA COLLECTIONS

Essential to the process of providing effective access to multimedia collections is the construction of navigation structures. This challenge is even more relevant when dealing with combinations of heterogeneous collections from different institutions. In the access to the content CHIP does not want to restrict the user to follow a predefined path, and so a navigation structure is needed to prevent the user from getting lost and to provide the desired information smell.

- *Browsing and searching*: In the wealth of cultural information it is impossible to find and study all the information a user needs by just browsing (as traditionally referred to in hypermedia research). Therefore a combination of browsing and searching will enable users to quickly get to the desired information, as we investigatd in for example OntoAIMS (Figure 3), Topia (Figure 1, 2), and Noadster(Figure 4).

- *Conceptual structuring*: In two- (or more-) level hypermedia architectures (as originally developed by Bruza [7]), we move from content level to concept level. The navigation through the search results can then be generated from the underlying structure.

For the generation of effective navigation, it is needed that searching and browsing can be seamlessly integrated. Especially graphical representations of the concept structures can be used as an integral part of the presentation. Usability testing is planned on a number of navigation and search interfaces in order to determine the most suitable way to reach the desired information for different user categories.
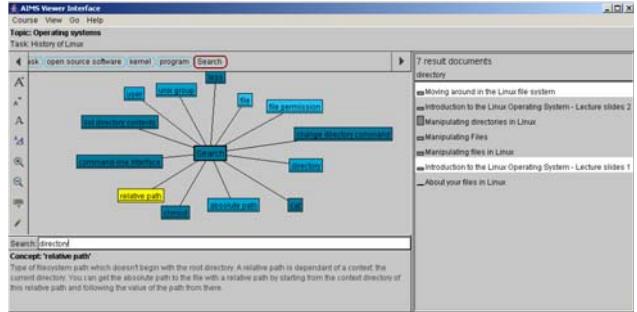

Figure 3. OntoAIMS: Search & Browse Interface[6]

4. PRESENTATION OF MULTIMEDIA COLLECTIONS

The presentation of the content from multimedia collections asks for a combination of ways to structure the content for the user. In the previous section, we discussed how (hypermedia) navigation is one of the ways to do so. In the CHIP project, we focus as well on a number of other approaches:

- *Narrative smoothing:* The integration of information from different cultural heritage sources does not automatically result in a sensible "story" [1]. The problem of combining different information fragments into a sequence (or other structure) is known as narrative smoothing. In this research we concentrate on what information must be provided by the different information sources in order to ensure that a sequence of information fragments becomes sensible [6].

- *RDF lack of structure:* The explosive adoption of HTML and the WWW is due in large part to its immediate delivery from author to user: once the author encodes a document in HTML and posts it, any user anywhere can access it with general-purpose browsers. With the shift towards the Semantic Web there is a concern that such immediate accessibility would not be possible because RDF lacks the structure (mainly hierarchy and sequence), of HTML and XML. RDF intentionally lacks hierarchy and sequence, choosing instead to facilitate machine-processing of the assertions it encodes. Lacking document structure means lacking the document form all users are familiar with, making many RDF interfaces unapproachable to users. On the other hand, if we can convert RDF structure to document structure in a domain-independent manner this would give the

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[6] http://www.win.tue.nl/~laroyo/AIMS/index.htm

information it encodes the same accessibility and approachability HTML enjoys. In this research the first steps in this direction have been made with the Noadster RDF semantic browser (Figure 4).

Figure 4. Noadster: RDF browser[7]

5. PERSONALIZATION AND ADAPTATION OF MULTIMEDIA PRESENTATIONS

The personalization in CHIP is realized with the help of a user model containing the interests, goals, background and knowledge of the user; contextual information such as the physical location of the user, his/her orientation, the time of day, the device and network he/she is using to interact with the system. This user model is an extended version of a previously developed in the SWALE project as an ontology-based interactive user modeling. The presentation of the selected relevant content objects to the particular user is then further adapted to the context and the environment. In general, systems can be made to become proactive, selecting and presenting information that matches the user's interests and needs without the user having to express that need through a question. A mix of active and proactive behavior can be used in order to prevent an agent from becoming boring because an agent will never surprise the user with interesting but unexpected information. To achieve this goal of personalization, we can exploit the availability of syntactically (XML-based) and semantically (RDF/OWL based) integrated metadata and thus open new avenues for personalization of the presentation.

The personalization does not just influence the presentation. Adapting the way objects are organized is also an import aspect of personalization as the usefulness of the content structure largely depends on the knowledge of the user and the medium that is used. A challenge will be to find ways to achieve this goal while leaving responsibility for the collection to different institutions including some form of responsibility for their presentations.

6. RELATED WORK

In the Topia project, research has been done on the navigation through visual cultural heritage information using presentations dynamically structured based on existing and external metadata and preferences of the user. This collaboration between TI, CWI, IBM and TU/e can be seen as a preliminary step towards starting the CHIP research. Also, the CHIME (Token2000) project in which the VU, CWI and TU/e collaborate aims at an initial architecture to allow task-oriented access to cultural heritage information. The NWO DYNAMO project in which CWI and TU/e collaborated and a related part of the RTIPA ITEA project have resulted in an approach to adaptation to device characteristics (for example demonstrated in the Hera software). Combining browsing and searching, and presenting information as well as visualizing the corresponding conceptual information is being investigated in the SWALE project (NWO sponsored collaboration with the University of Leeds), exemplified by the OntoAIMS software. The true challenge in the CHIP project is to bring isolated approaches to different aspects of the creation of adaptive applications together and produce an effective, distributed adaptive web-based architecture for the cultural heritage field.

7. REFERENCES

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[7] http://homepages.cwi.nl/~media/demo/noadster/