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HAVE YOUR CHOCOLATE AND EAT IT TOO: INTEGRATING CONCEPT MAPS INTO A CONTENT MANAGEMENT FRAMEWORK WITH RELATIONAL DATABASE CONNECTIVITY

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Abstract. The maturation of high-speed internet and web technologies, combined with the massive volume of information available through the World Wide Web, has enabled and motivated many people to access the internet whom might never have chosen to do so previously. Perhaps the most difficult challenge that computer programmers and web designers face today is the development of easy to use systems for neophyte computer users that simultaneously allow for robust, queriable access to their own, and to other, complex information sets and technical content in an efficient manner. In this paper we report on the ongoing development of the Chocolate Research Portal, a portal designed for use by both expert historical researchers, as well as the general public. The portal design uses concept maps in a content management framework as the primary means whereby content is collected, organized, curated, searched, and disseminated.

1 Introduction

The Chocolate History Project, headquartered at the UC Davis Department of Nutrition, is a consortium of approximately 60 scholars and technical researchers spread across the globe whose primary aim is to document and determine how, when, and where chocolate products were introduced and dispersed throughout North America. The Chocolate Research Portal (CRP) was developed in an effort to aid in the collection, categorization, curation, and display of chocolate-related artifacts and documents.

The CRP has been designed, and continues to evolve using ten guiding principles:

1) Easy operation during, and/or integration with, fieldwork data collection;
2) Easy tracking and sorting of chocolate-related historical data by date/conceptual era, document type, geographical area, topical theme, and specialized vs. general interest;
3) Ability to search documents by key words, and to save these searches for sharing with others;
4) Non-reliance on proprietary technology/commercial software licensure;
5) Easy access to students, general public, press corps, scholars/scientists on the WWW;
6) “Eye-catching” appeal;
7) Granular security model and publication workflow for storage, curation, and distribution of content;
8) Ability to aggregate, quantify, and report on tabular numerical data from different sources;
9) Ability to annotate images, of graphics, artifacts, and documents;
10) Ability to integrate with maturing semantic web technologies.

Because no free/open source solution has met all of our needs, we integrated a suite of free/open source technologies including a concept mapping server where concept maps play integral roles in the overall functioning of the portal.

2 The Components: Concept Maps, Content Management, Databases, and Files

By integrating a concept mapping system with both a content management system and a relational database management system, we have been able to leverage the power that each technology has to offer in order to create a complete knowledge environment. Detailed below are the major roles that each component plays in this knowledge environment.

The Concept maps serve several functions inside the Chocolate Research Portal:

1) Provide users with a rich visual interface;
2) Organize content that may not be visible in a traditional folder hierarchy;
3) Provide access to saved search results from queries of related content;
4) Integrate CMAP OWL ontologies from with the underlying the portal catalog/index (ongoing);
5) Assist concept map creators with the building of new maps, through the use of assistive technologies (ongoing).

The content management framework provides:

1) Built-in granular security, workflow, and document sharing capabilities;
2) Built-in ability to create and reuse custom content types and/or their components;
3) Integrated relational database access;
4) Integrated and searchable catalog of all content/content types that exist within the portal;
5) Customizable "skins" to create dramatic visual themes within the interface.

The relational database management system allows users to:

1) Store, aggregate, query, and quantify data that easily fits inside table formats;
2) Upload their offline field notes about artifact and document images kept in spreadsheets.

Large binary files such as images, sound recordings, and videos can be stored in the main file system and can be managed through the content management framework. Figure 1 details the logical infrastructure of the Chocolate Research Portal.

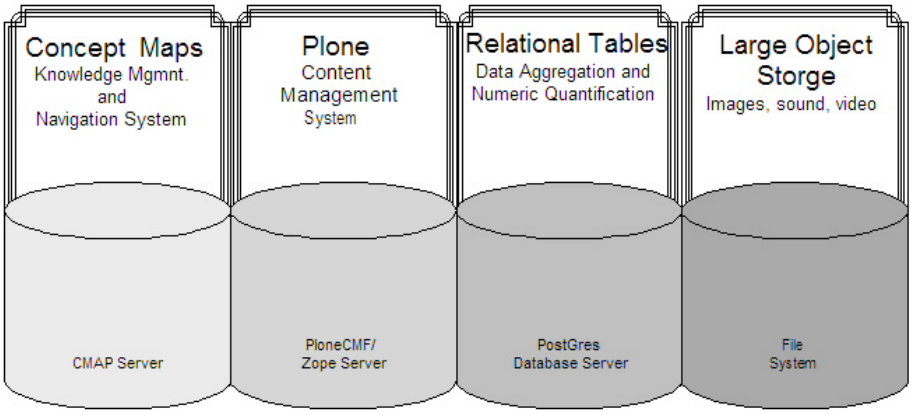

Figure 1. Logical Infrastructure of the Chocolate Research Portal

3 Putting it into practice

When affiliated researchers are working in the field (i.e. in archives, libraries, or museums), disconnected from the web, they keep their notes regarding archival documents and artifacts that they encounter, in spreadsheets. When researchers return from the field, images of artifacts/documents combined with spreadsheets of notes about individual images, can be uploaded to the web portal directly through a drag-and-drop webDAV client. The images and spreadsheets are stored on the file system but they are cataloged, indexed, and secured through Plone's content management framework. Once the images and spreadsheets are uploaded, the spreadsheets are appended to appropriate tables in the relational database. Figure 2 illustrates a spreadsheet used to capture poster information.

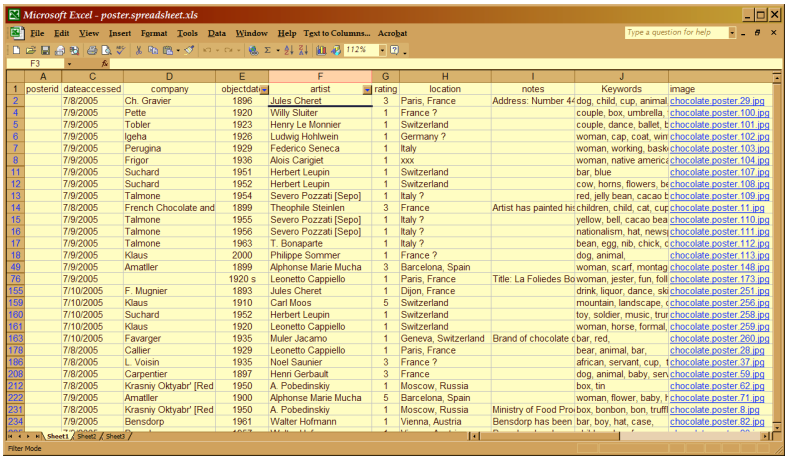

Figure 2. Sample uploaded spreadsheet

Once field data are uploaded into the relational database the information is associated with the corresponding images, to create metadata "tags" about the images that were just added to the site. Each row in the spreadsheet is correlated with one image document; each column represents one metadata element. Figure 3 is an example of a poster that contains associated metadata created by a feed from the relational database.

Figure 3. Image plus metadata from spreadsheet

Once content is aggregated and cataloged in Plone, it is possible to execute and save searches with specific search criteria into "smart folders." Except for the editable criteria used to define the smart folders, these folders look and act like regular physical folders, except that they are really storing the results of the query, which are pointers to their actual physical location. Note that content is not moved into these folders, it is only visualized there. The result is that the same content can appear in multiple smart folders, depending on the folder's search criteria. Figure 4 is an example of a smart folder whose criteria are concepts related to the word "romance".

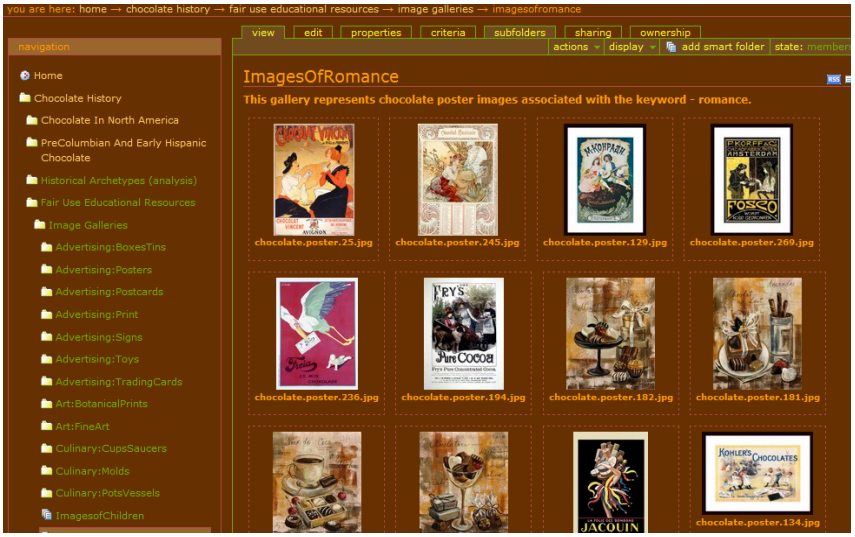

Figure 4. Results of a saved query or "smart folder"

Concept maps guide the user through the site based on related concepts, content, content type, or whatever other relationships the knowledge modeler chooses to map out and identify. As knowledge models are built through the CMAP Client interface, they are exposed to the Chocolate Research Portal through CMAP Server web interface.

Figure 5 is an example of a concept map that points to other maps, images, and smartfolders. In this example the central concept, "Romance" points to the smart folder that contains query results for "romance" and related terms (as in Figure 4), while other concepts contain resources that link to other smart folders, concept maps, or specific content items.

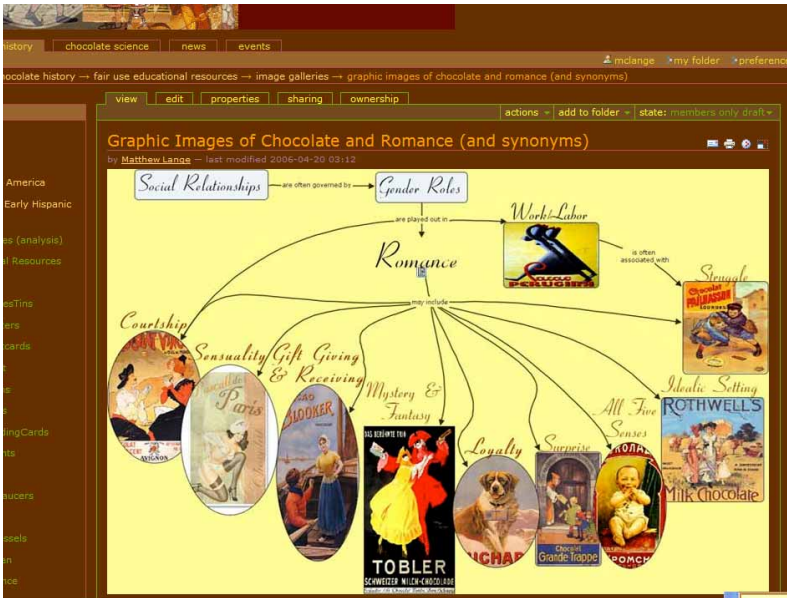

Figure 5. Sample Chocolate Portal Concept Map

4 Next steps:

Now that the basic infrastructure is in place, we will further integrate these powerful tools to create a more dynamic and engaging user experience while automating some of the tasks associated with uploading data. We are developing two important types of integration:

1) Creation of a "concept map" content type, so that concept maps can be available for query in the portal catalog as with other documents;
2) Integrate and customize the Plone Ontology plug-in—this will allow us to save our concept maps as Ontology Web Language files (OWL), and have these same OWL files automatically indexed in real time as they are created. Then, based on the relationships defined in the OWL ontologies, users will be able to see related content items and content types while they are looking at specific content items.

Once these integration steps are complete, it should be feasible to import other domain ontologies to extend our knowledge web, and ultimately automatically create CMAPS based on semantic relationships that exist between content objects existing within the Portal.

5 Summary

The Plone content management framework and Postgres relational databases provide our project with many built-in features for data and content integration. Our current use of concept maps is to provide a rich graphical user interface to the knowledge portal end user, as well as for our editorial staff and knowledge modelers to explore possible relationships between and among concepts. We look forward to further integrating both concept maps and related semantic web technologies in the continued development of our Chocolate Research Portal.

6 Acknowledgements

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