DATA AND METADATA IN ARCHITECTURAL REPOSITORIES

HERMAN NEUCKERMANS*, MARTIN WOLPERS°, MATHIAS CASAER* AND ANN HEYLIGHEN*

* K.U.Leuven – Department of Architecture, Urbanism & Planning
Kasteelpark Arenberg 1, 3001 LEUVEN – BELGIUM
herman.neuckermans@asro.kuleuven.be, mathias.casaer@asro.kuleuven.be, ann.heylighen@asro.kuleuven.be

° K.U.Leuven – Department of Computer Science
Celestijnenlaan, 200, 3001 LEUVEN – BELGIUM
martin.wolpers@cs.kuleuven.be

Abstract.
In many schools all over the world, teachers as well as researchers have been developing digital learning contents. These contents exist mostly in isolation; that means in and within a school or in the personal files, although it would be much more profitable to the community of teachers in architecture to share the results of all these efforts.

In this paper we present and discuss two different strategies regarding this ambition: The first develops digital pedagogical material and tries to invite others to contribute in order to create a big repository. As an example we will present DYNAMO, a dynamic architectural memory on-line built over the last 8 years, with to date more than 600 architectural projects fully documented with plans, pictures, texts and a fairly developed category search engine.

In the second approach every owner of a repository keeps his/her data and shares its content with others through a central search engine. As an example we will present and discuss a recently launched EU-programme called MACE – Metadata for Architectural Contents in Europe – which aims at enhancing the metadata of as many as possible different repositories in order to allow searches by distant partners. Real access conditions to the data still will remain those specific for each repository.

The purpose of this paper is to share information and (similar?) experiences in Asia or outside Europe in general.

1. Problem statement

All over the world schools, of architecture have moved into the digital era. Students produce digital analyses of buildings, have been modelling exemplars, teachers have been developing learning materials, tutorials, power point presentations, animations, etc. in digital format. As a result, many schools today have a large number of digital learning contents in the architectural domain. Unfortunately, the material is not shared over school boundaries thus is not exploited to its full extent. Mostly, technical and organisational limitations do not allow for the exchange of learning material although this would be for the benefit of the global community of teachers in architecture.
2. DYNAMO

Inspired by the idea that designers learn from previous experiences, we started several years ago to collect cases in DYNAMO, a dynamic architectural memory on-line (Heylighen & Neuckermans, 2000; Neuckermans, 2002). This database is today hosting more than 600 architectural cases represented in 9334 files: drawings (sketches, plans, sections, details), pictures, texts (in various languages), references (bibliographies, websites,…), digital 3D models, other (analyses, case studies,…).

DYNAMO performs a variety of functions towards 3 different types of users. Functions can largely be divided into 4 main types being user administration, case and index administration, file administration and logging of user activity. This reflects in the conception of 4 databases, each providing a customized data structure.

User Administration is divided by distinguishing three profile types: administrator, monitor and user. DYNAMO is an open database meaning that each user can contribute contents to the system. These contents are checked and their quality is evaluated by an administrator before they are presented as such by the system. The monitor profile offers the necessary means for this by providing more general content management tools and specific verifying options to tag all the contents on a higher level. More administrative functions towards group management and other administrative functions on the data level are covered under the administrator’s profile.

Case administration in DYNAMO happens dynamically. When DYNAMO was originally created, we could not come up with a satisfying categorization that would last over the years and contain enough placeholders to fully describe a case. We decided to tackle this problem by tagging the architectural cases in DYNAMO with metadata in a more indirect way. To describe various properties of the cases a dynamic category structure has been implemented. For each case, this structure is used to specify the various properties of that case by the selection of specific values for the categories. The category structure can be seen as a sort of template, as it allows us to organize the properties of a project hierarchically and to change it over time, without programming or implications for the database. For example, if tomorrow the total estimated cost of each case needs to be specified, a ‘cost’-category merely has to be added by a monitor through the interface. The cost will then be a property available for each case.

Most of the metadata describe cases within a specific context or ontology. We have defined these contexts by organising the categories into various windows, each window related to a specific field of interest.
The original creation of windows was inspired by the idea to tailor the access to the data along different user profiles (researchers, architects, designers, ...).

DYNAMO is primarily conceived as a learning tool for students by providing the data on-line. This results in metadata and content relevant from the perspective of students. For reasons of Intellectual Property Rights the database requires a login password. Actually the content of the database is the result of the ad hoc needs for teaching at our university: museums, for example, were inputted along with the introduction of a design assignment in the third year, houses were inputted in the context of seminars on housing in the first year, and recently 62 recent school buildings in Europe were inputted in the context of a research project. DYNAMO offers several search modes: ‘random’ browse, as well as directed multi-criteria search (combined categories and values).

Until last year we distinguished three windows, ID, design and theory. The categories in the ID window describe merely the general identification data of the case such as a name, the location, period and architect of the case.

The design window is basically structured along a “designerly” way of looking at the cases. It starts from the Vitruvian dimensions of architecture as search categories: “function”, “construction” and “form” (delight). A more detailed description of the category “form”, has been implemented by using the characteristics that make a space into a place, according to Christian Norberg-Schulz (1980) in his book Genius Loci. He produces empirical evidence proving that the character of a place stems from its history, its meaning and its identity. The identity comes from: its location (a), its formal articulation (b), its spatial configuration (c). Example: a cluster (c) of semi-detached houses (b) on a hill (a). The categories used in DYNAMO are thus not value-free because they refer to a belief in the phenomenology of place. This is not really a problem because no discourse on and in architecture is ultimately value-free.

The metadata of DYNAMO refer to the category structure, the case-specific values and properties, the file properties and the usage logs. The dynamic (search) category structure is represented in figure 1 and the structure of DYNAMO is depicted in figure 2.
**Figure 1**: Metadata of DYNAMO and dynamic category structure

**Figure 2**: The structure of DYNAMO
Recently a new window, named “construction” and dealing with construction issues, has been implemented. It is targeting another type of users/teachers, namely those ones learning/teaching construction as a part of the education of an architect. One of the implications of implementing the construction window was that part of the category structure for the design window was also required in the new window. In order to implement the possibility of adding the same category to more than one window, the internal structure of the database has been revised, figure 3, by introducing an index table with pointers from the windows towards the categories making the category structure more versatile.

![Figure 3: Index table linking the windows with the categories](image)

After more than seven years, DYNAMO is performing well and serves the purpose within our school and in some places abroad. It has more than 1000 registered users from more than 12 countries. So far many schools were invited via personal communications and presentations at conferences worldwide to make use of the repository and if possible to enrich the content by also inputting cases. Whereas many have joined the club, almost none has contributed actively. The reasons why can be manifold: maybe there is not enough confidence and/or guarantee that third party’s effort will remain accessible for ever, maybe it is too much of an effort to input cases, maybe the contents are not comprehensive enough or not specialised enough,…

### 3. MACE

The MACE project takes a completely different strategy to sharing efforts, information and learning materials between schools of architecture. MACE, Metadata for Architectural Content in Europe, is supported by the eContent+ programme of the European Union (http://www.mace-project.eu). It aims at creating a European-wide
space for the electronic descriptions of architectural information for the use in architectural programmes in higher education.

Throughout Europe, and possibly beyond, electronic learning materials for the use in architectural education are stored in a large number of diverse and heterogeneous content repositories. The learning material, in general called learning object, is well used in the respective schools but most often focuses on specific areas only, thus limiting access to information on specific domains only. As modern education in architecture requires a broad range of information, and one repository cannot provide all these information, the MACE project addresses this gap. So far, no simple solution exists to find suitable and overarching learning objects in the architectural domain school- and system.

MACE will federate a number of these already existing repositories and will enrich the learning object descriptions to facilitate a simple and efficient access to these learning materials.

3.1 MACE LEARNING OBJECTS AND METADATA

Learning objects are generally described through a number of metadata fields. This description allows the retrieval of the learning objects for specific applications, e.g. the targeted search for a certain learning object. The set of metadata fields describe the content, the domain, the necessary competencies for and the usage of each learning object. The content and domain metadata describe the nature of the learning object, its representation and/or manifestation in real world, its storage place and its location in some architectural classification scheme. Usage metadata describe how the learning object was used in which situations and contexts by whom. These data provide highly valuable information on the usefulness of learning objects thus can be used to improve the user-targeted retrieval of learning objects. Metadata describing the necessary competencies that are associated with each learning objects provide further personalisation services, e.g. by comparing the required to the already acquired competencies a learner has. The metadata on usage, competencies and context will enrich the metadata provided by the content providers. For the purpose of this paper, a more detailed discussion of the metadata fields is not necessary and would exceed the limited space. The interested reader is referred to the respective literature.

The Learning Object Metadata standard (LOM) is used to formalize the description of the learning objects (Duval, 2005). LOM is an extensible IEEE standard that allows incorporating new metadata fields as the need arises.

For the DYNAMO project, the metadata describing the learning object are two-fold: on the one hand, the physical properties like the
technical identification, the file name, author name, file size, etc. are captured. On the other hand, domain metadata describing the architectural properties are described in the three categories identification, design and theory with subcategories like the architect’s name, the building type, the material, the location of the architectural object represented in the learning object, the illumination, etc. MACE will map the metadata into the LOM standard based on the application profile developed in MACE. Mapping will be straightforward by including the content repositories directly or referring to suitable domain ontologies where possible.

3.2 THE MACE INFRASTRUCTURE

The MACE infrastructure is based on the approach to federate the several existing content repositories and enrich the learning object metadata with information on the usage, the context and the competences. The approach aims to make the learning objects in all repositories findable to the regular user. Finding the learning object will be enabled through a search mechanism that allows simultaneous searching over the content of all federated content repositories. Each repository makes its learning objects accessible through the aforementioned metadata descriptions, e.g. in the case of the DYNAMO store through case/project categorizations. In order to facilitate searching, the learning object metadata of each repository are harvested into one central content metadata repository. Access to the actual learning object is nevertheless controlled and managed by the content provider as only the metadata description of learning objects are shared in the central metadata repository.

Harvesting here means the transfer of the metadata from the respective repository into the central content metadata repository on a regular basis. Note that only the metadata describing the learning objects is transferred. The learning objects themselves stay in respective repository thus stay in the control of their owner. Harvesting the metadata is done through harvesting interfaces at each content repository that implement the OAI-PMH - Open Archive Initiative Protocol for Managing Harvesting (OAI, 2002). Searching for learning objects is simplified to searching of their description in the central content metadata repository. The central content metadata repository will also offer an OAI-PMH interface so that interested content metadata providers can retrieve eventually enriched metadata suitable for their learning objects.
The DYNAMO repository will be integrated into this federation through the implementation of an OAI-PMH interface. So, if a user searches for content related to a topic represented in the DYNAMO repository, the respective metadata information in the central repository will reference her to the DYNAMO repository where the repository specific access control mechanisms will manage access to the learning object in question.

Data on the usage of learning objects, their context and competencies are also stored in respective repositories using similar approaches. To find suitable learning objects, a federated search application will search over the metadata stored in the various central metadata repositories. The federated search service will be enabled through the Simple Query Interface (SQI, 2005). SQI allows for the simple broadcasting of queries in small and medium sized networks and the agglomeration of the query results while being able to work with any query language.

4. Conclusion

A first inquiry amongst the schools of architecture in Europe resulted in a positive response from many schools willing to participate. Also at a recent conference in the USA a positive interest was expressed. This presentation is an open invitation to CAADRIAns.
References


