LOCAL VALUES in a NETWORKED DESIGN WORLD

ADDED VALUE OF COMPUTER AIDED ARCHITECTURAL DESIGN

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Technology and Local Values

Computer Aided Acting with Regional Heritage

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Abstract

The problems of storage of local cultural heritage in digital databases, are reported in the paper. An exemplar case of RuralXML framework is presented.
Three main groups of challenges relating to "culturally rich" databases are recognised:
Estimation of the significance of digital databases for supporting design process, educational needs and scientific investigations;
The conceptual problems with digital representation of "the paper heritage"
The technical problems related to the architectural databases.
The most important aspects of the problem are mentioned, as a background to a discussion about the reciprocal dependencies between technology and local values, i.e. how technology supports acting with the local architectural heritage, and how "cultural significance" values technology. We claim that digital technology not only enables storage and management of such data, but it also adds a new dimension to the design, making it "locally-sensitive" and oriented towards context by means of employing digitally archived architectural data. The accessibility to information about the "local" architecture heritage is important for local as well as global design. The premises for such statements, are presented.

1. Reworking Paper Heritage

Urban and Spatial Planning Department on Faculty of Architecture, Technical University of Bialystok owns over 600 kg (!) of the high-quality photos and paper drawings, describing rural areas in North-East Poland. The documents contain plans, elevations and sections of hundreds of buildings, about 30 detailed large-format plans of villages with hundreds of additional drawings (street sections, panoramas) and text data (thousands questionnaires about buildings and sites, bibliography, relative texts, citations). This huge mass of documents, although containing valuable information, has been unused until now because of its amount and lack of proper classification and storage methods.
We were unable to use this valuable material, so that we started to analyse the potential of networked media for archiving such "culturally significant" documents. The first

stage was the analysis of computer tools for acting with digital representations of local cultural values in order to describe and manage architectural cultural heritage [Szewczyk, 2002b]. Then we investigated existing architectural, digital notations of spatial data, focusing on their usefulness for storage of "culturally significant" data [Szewczyk, 2002a]. The third stage was development of the RuralXML database, i.e. a collection of digitally stored documents managed by XML definitions [Korolczuk and Szewczyk, 2002]. The RuralXML database was to contain initially information about local regional architecture, but now it is being created and optimised to describe Polish traditional rural architecture for scientific investigations of architectural, rural and spatial planning fields. It indexes graphical and other information essential for representing cultural heritage and local values.

2. Significance of the Problem

In Poland there are 15 Faculties and Institutes of Architecture in existence. Nine of them have archived rich collections of drawings, photographs and other documents reporting past and present state of regional Polish architecture. A few older universities have been archiving this material since the beginning of the XX century until now (for example Warsaw Polytechnic, Cracow Polytechnic); a few other gathered and fixed newer data in 70s, 80s and recently. It is believed, that collected documents are of great value, because of richness of information, and because of their uniqueness and importance for historians, sociologists and architects. Examples of "local", architectural heritage data, collected by Bialystok Polytechnic, are shown on the figure 1 and figure 2.
There were many attempts for cataloguing these data in the past [for instance: Zarnowiecka, 1993; Zarnowiecka, 1994], but generally none of them (digital or paper-based) was satisfactory and finished. In 2001 we started to investigate, how we can catalogue our collections of data related to regional architecture, using computers, databases and CAD software.

First, we tried to justify this idea, analysing the significance of the problem. We found the value of collected data unmistakable, but the collection was temporarily unusable because the data items were not catalogued nor organised. We appreciated the digital technology for cataloguing and managing data, because it enables more efficient storage and management of a large amount of such hybrid information, and prevents from destroying existing collections fixed on paper media.
We also believe, that computer technology can add some new value to the design process based on local inspiration, because:

- It adds a new "dimension" to the design through derivation of value from the collected sets of local aesthetical data and processing it creatively;
- It makes design "locally-sensitive" and oriented towards context by means of employing digitally archived architectural data representing surrounded space.

The premises for such statements are presented below.

1. Computer software speeds up searching and recalling sets of graphical data.
2. CAD and graphic software enriches and speeds up processing data creatively, for example thanks to a variety of filters. These capabilities are valuable especially when processing a large amount of graphical and non-graphical data.

3. Computers can be the powerful tools for managing databases of scientific information. We believe that our database of regional architecture can supply scientific investigation into architectural heritage, and can be a source of inspiration for design.
4. The accessibility to information about the "local" architecture heritage is important for local as well as global design.
5. We believe that computer software can help us with comparing elements of architecture, extracting types and exceptions, analysing forms, etc. All these activities are common for scientific and design work.

From these assumptions the conclusion can be deducted, that computer databases of regional architecture equip both architects and scientists with the same tools and methods of acting with "culturally significant" data. Computer-managed collection of local, regional architectural data can be an efficient "source of inspiration" for designers, adding value to the design process.

3. The Challenges

After an investigation into the usefulness and significance of digital representation of local cultural heritage for creative, educational and scientific needs, we met unexpected problems with satisfactory applying such methods and development of the database. Three main groups of challenges relating to "culturally rich" databases were recognised:
1. Estimation of the real, practical significance of digital databases;
2. The conceptual problems with digital representation of "the paper heritage";
3. The technical problems related to the architectural databases.

First, data structure and contents in the database should depend on expectations of users, i.e. existing "paper heritage" data should be rewritten and optimised to meet well defined expectations satisfactorily. We should first estimate in detail how digital data are going to be used, by whom, for what purposes. We should estimate the real significance of digital databases for supporting design process, educational needs and scientific investigations. Of course, all these factors are reciprocally dependent on initial data resources to be rewritten and digitally stored. These all factors seems to be obvious, and the requirements (mentioned above) seems to be simple to define, but in fact they are not obvious nor simple. In Polish literature we have found some dozens of suggested definitions of data sets for collecting architectural data for educational and scientific purposes, for heritage preservation, for statistical estimations, for rural and urban planning, for administrative and governmental purposes (most of them were not digital, by based on catalogue cards), but no one was satisfactory. After two years of efforts we collected and digitalised a great number of data and we build a few prototypes of data sets (an exemplary set is shown on figure 3), but we have not solved the initial problem: how data structures should satisfactorily meet users' requirements.

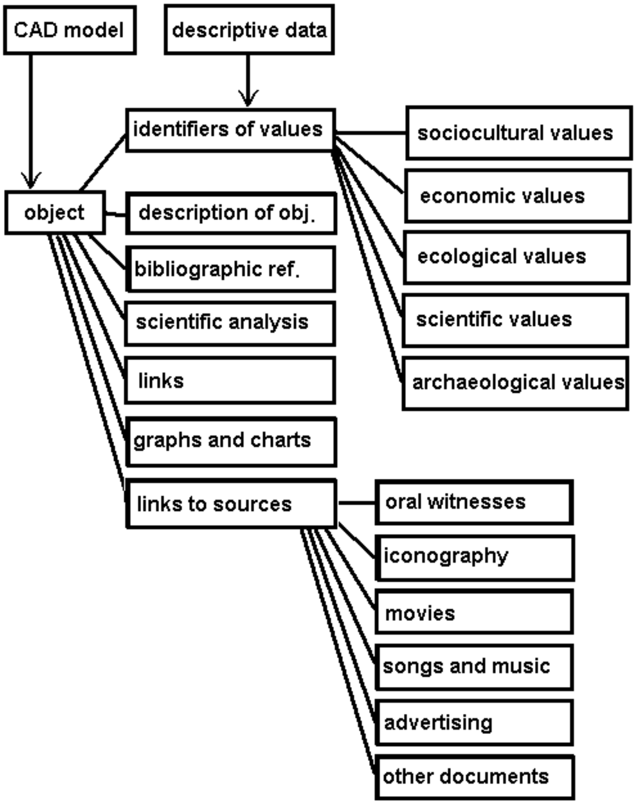

Figure 3. One of the analysed data sets for cataloguing architectural information (considering identifiers of local values); based on precedent work by Liguori et al [2001]

Second, we have not overcome of the “paper data” problem. Our initial intent was that digital data could replace paper documents. We wanted to get rid of a large mass of paper data, formerly storing it digitally. Paradoxically, we collect both digital and paper data now, because it turned out that in many cases paper data (for instance graphical: illustrations, large designs and especially large format plans of cities) are more flexible, clear and easy to use than digitally stored data. In other words, paper media remained requisite.

For example we tried to digitalise a three meters wide and four meters long map of a village Mielnik (scale 1 : 1000, very detailed, containing descriptive characteristics of over 500 sites with building material, geometry, functions, etc.). This map was made by students in 1993 in a week, but we estimated that repairing and digitising this old map could take over a month using CAD and database software. Now we found this work pointless, if made without GIS systems and if we cannot display the map on very large monitors. Besides, we had to make digital data redundant, because the same data items referred to statistical sets stored in MS Excell, to graphic (raster) files, to vector DWG or SVG files and they were linked to a variety of external or attributed data. But, this is not the one map we possess. We have about 30 detailed large-format plans of villages with hundreds of related documents. We can isolate 31 types of data from each map, each type of data is represented by 200 – 2000 records in one map. Many records should be redundant, stored graphically or should refer to other graphic data.

4. Technical Problems

When developing open architectural database, containing local heritage data, we dealt with some technical problems.

4.1. Acting with Architectural Metadata

We analysed architectural data, classifying them as a special example of hybrid metadata. The problems of managing hybrid metadata (digital data repositories and digital libraries) have been recognized by a few researchers [Kahn and Wilensky, 1995; Arms et al, 1997; Loudon, 2000]. Attempts to reshape architectural data in order to get consistent database for design, educational or scientific purposes (composed of three types of libraries: specifications library, case library and "generative mode" library) were made by Gu and Xie [1998]. But, we noticed the lack of CAD tools merged with open databases, optimised for architects' needs.

We focused on the concept of data repositories recognised by Arms et al. [1997]. They recognized four main modules: (1) user interfaces, (2) repositories, (3) handle systems used to identify resources, and (4) independent search systems, based on query languages and keyword search capabilities. This modular approach seems to be applicable for architectural databases for scientific and educational purposes, and – conditionally – for design [Korolczuk and Szewczyk, 2002], but we suggest to add a fifth module, (5) processor of graphical data, i.e. CAD engine. The problems and advances with development of these five modules are outlined below.

4.2. User Interfaces and Data Processors

Common interface problems in CAD systems were recognized in detail and divided into 24 groups by Jakimowicz and Szewczyk [2001]. Integration of CAD data and user interface was recognized as an important aspect of engineering systems [Anumba, 1996]. Arms et al. [1997] suggested necessity of dual interface for digital libraries, i.e. one interface for users (data extraction) and the second one for managers (data processing). This can make sense in scientific and educational databases linked to CAD systems. A few interesting interface concepts were developed for systems assisting conceptual design.

4.3. Data Repositories

Szykman et al. [2000] described a web-based repository system for acting with corporate design data (emphasizing the differences between databases and data repositories). Gu and Xie [1998] discussed the implementation of the dynamic engineering component database, focusing on the data organisation and access. Arms et al. [1997] recognised problem of restructuring data, classifying them into: (1) digital materials, (2) key metadata, and (3) structural metadata describing the types, versions, relationships and other characteristics of digital materials. Others suggested multi-levelled architectural data organisation using the XML syntax, but there are also sceptics, such as Fisher et al. [2000], who insist that XML specifications suffer from a conceptual deficit, and that XML was not primarily intended to provide containers for data storage, but to enable data transfer between domains.

4.4. Search Systems and Handles

Search systems of two types are essential for large hybrid data repositories: query-based search engines (query languages) for extracting data records from databases with known structure, and keyword search engines for searching unstructured data. When dealing with heterogeneous, complex, unclear architectural metadata, search systems must be well integrated with handle systems and indexing services. Handles identify resources over long periods of time. Identifiers indirectly reduce data redundancy and increase flexibility of data structures.

4.5. Graphical Data Processors

There are many type of data processors. We have focused on CAD engines, because of their abilities to effective manage complex data, not limited to graphical shell. But, we can foresee possible problems with public sharing CAD data, because CAD technology remains unfamiliar to public. That is why we suggest to develop partially redundant data structures, with CAD data doubled by appropriate raster files.

5. The RuralXML Case

In 2000 we started and continue to develop the architectural database RuralXML, defined by the XML Schema definitions [Korolczuk and Szewczyk, 2002]. The RuralXML project was initiated in order to describe Polish traditional rural architecture for scientific investigations into architectural, rural and spatial planning fields. Now we conduct parallel investigations on three areas: (1.) on the database content, (2.) on tools for acting with the data, and (3.) on open data sets, representing graphically local cultural heritage and including context.

Now there are three main objectives of the work:

- The first objective is to digitalise the existing rich architectural data, and to create methods for storing information about data context, about its local value and for acting with the digital representations of local cultural heritage.
- The second objective is to develop a software tool with an efficient graphical interface, enabling acting with the open, not fixed metadata and their context. We found it essential that both the data and their structures must be represented graphically.
- The third objective is to develop methods for extended acting with the existing CAD and other graphical and non-graphical data, so that the local values, spatial and cultural context, context of events (timeline) and other data related to cultural heritage could be represented.

XML syntax can be used to represent both, structured data (in this case records in bibliography database or items in building databases) and unstructured data (text, unstructured graphical information). For that reason it is important to have tools that can select records from the structured database (XML query language) and search for information in text (keyword search). Several of these tools were developed or analysed by Badard and Richard [2001], Deutsch et al. [1999], Florescu et al. [2000], and Houlding [2001]. These tools will be implemented in the future. Now the simpler methods based on XML syntax are being developed. Problems with access to application-specific data (GIS, CAD, raster) are taken under consideration, too. Of course there are plenty of viewers accessible, but our objective is to choose the simplest, but the most powerful software. For example a few CAD viewers can be unified with web browsers, so users can work with the data without leaving a browser. Now the database is working with the AutoCAD files, and graphical information is stored generally in two groups of formats: vector AutoCAD-based (DWG, DWF with tendency to migrate to XML-based SVG format) and popular raster formats, such as BMP, JPG and GIF.

6. Conclusions: Technology and Values

The digital technology is expected to solve problems with surplus of data. It offers tools for effective management of a large amount of hybrid data, such as architectural, "heritage – sensitive" information. Technology does not always add value to data itself, but it enables effective usage of existing valuable data. Many data cannot be used without an advanced technology.
But, on the other hand, not only technology supports acting with the local architectural heritage, but, the other way round, "cultural significance" values technology, and the cultural values can interact with technology and data. We believe that, after digitalisation and publishing, our collections of information about Polish traditional rural architecture will stimulate other scientists with their scientific investigations into architectural, rural and spatial planning fields, and will inspire and enrich design activities.

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Keywords

Architectural Content, Graphical Notations, Cultural Heritage, Local Values, XML, RuralXML,

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