VISUAL KEYS TO ARCHITECTURAL DESIGN

H. NEUCKERMANS AND A. HEYLIGHEN
KU Leuven CADLAB Department of Architecture
Kasteel van Arenberg Kasteelpark,1 B-3001 Leuven Belgium
Herman.Neuckermans / Ann.Heylighen@asro.kuleuven.ac.be

AND

P. MORISSE
Pieter.Morisse@asro.kuleuven.ac.be

Abstract. This paper presents a new mechanism to access and interact with DY*N*AMO, a collective case base for architectural design developed as a Web-based tool. The system is fully operational since a few years in the context of architectural design education as well as for seminars on architectural theory. We have now developed a set of visual keys structured at the one hand according to the Vitruvian tripartition of architecture: Firmitas (structure, materials,…), Utilitas (building programme,…), Venustas (formal qualities/articulation, spatial configuration,…) to which we added Context (topography, site, budget, climate,...) as a supplementary dimension, and at the other hand including three levels of detail: single spaces, building blocks or master plan entities. Visual keys match the architect's designerly way of thinking. The visual keys are in fact nothing else than a graphical codification of architecture within the realm of architectural composition. The software, that has been developed so far, does not only allow users to access cases via the keys we have implemented, but it also provides a tool to sketch and submit their own keys.

1. The DYNAMO case base

DY*N*AMO (Dynamic Architectural Memory Online), initiated in 1996, is a fully operational case base for architecture, allowing to easily access design cases online (Heylighen, 2000). Within the context of several research projects its content has been and is expanding, while its architecture has been revised. Till today the case base is accessible through indices, which allow various (combined) searches depending on the interests of the users – designers, theorists, historians. Architectural designers browse 'at random'

in order to load their batteries, for creative action requires previous experience (Koestler, 1965). They can select specific cases by author or project name, or narrow their choice by specifying multiple criteria as shown in Figure 1. Architectural theorists on the other hand are frequently looking for currents and tendencies in architecture, for example the collection of houses that are representative for the twentieth century production in a given country. Historians as a rule are more interested in the diachronic evolution of buildings. Each of these user types have other expectations, demand other services from a case base and hence, access mechanisms adapted to their needs.

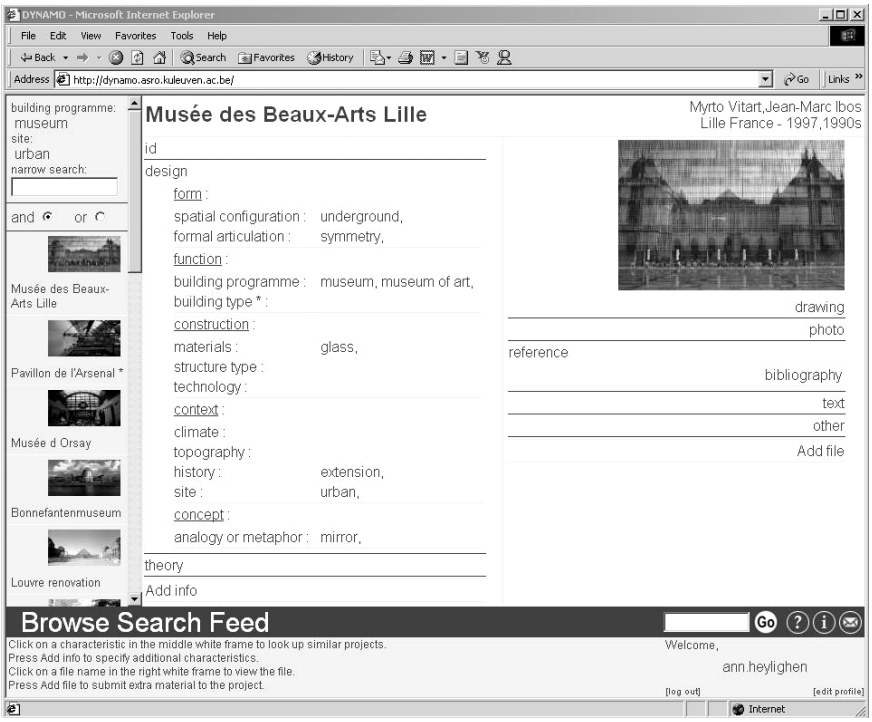


Figure 1: Screen shot of DYNAMO's search result when looking for a particular building program (museum) on a specific site (urban).

Today DYNAMO contains more than 180 projects related to different themes or programmes in response to ad hoc teaching demands. Up till now cases contain graphical data like plans, sections, elevations, drawings and alphanumerical information, yet in fact they can contain whatever can be communicated through the Internet. A crucial issue of debate in building such a case base is whether cases should be presented as such, i.e. as raw material, or rather as an interpreted reality, to be more precise as the result of analysis. Most schools of architecture have the subject of analysis on their curriculum, more and more in a digital version and therefore it seems a good

opportunity to share the results of these efforts within the wider community of architectural education. Most schools would be interested in these digital models allowing virtual 'promenades architecturales' through the building.

If a case goes beyond the raw material, then its modelling presupposes a lot of choices and is dictated to a large extent by the intended use of the case, by what questions will be asked. If, for example, you are interested in the daylight conditions in the National Assembly Building of L. Kahn in Dhaka, then the modelling should include these. If the circulation is very peculiar in a building, it should be easy to generate it from the model. So even in the case of 'raw' material, the digital realm asks for a clever data structure and/or layering of the model.

As far as software is concerned, DY*N*AMO is currently structured as shown in Figure 2. In essence, the tool consists of 3 major components: 1. a collection of design cases - the actual case base of DY*N*AMO; 2. a database (MySQL) that organises and structures these cases; and 3. a user interface to both consult and modify the case base. Cases and database are stored at the sever side; users interact with DY*N*AMO through a standard Web-browser at the client side.

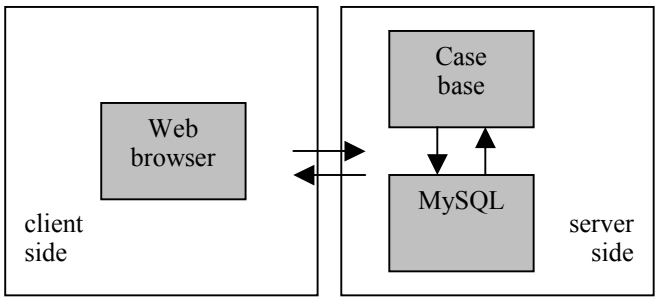


Figure 2: DY*N*AMO's 3 components

2. Designerly access for architects

Indices to access the cases are dictated by the type of users. What are the expectations of an architect or student in architecture who is willing to learn from past experiences, who is looking for inspiration while designing? The designerly way of thinking, quoting Nigel Cross (1982), is graphical, and proceeds through, in and with images in contrast with the 'numeracy' of engineers and the 'literacy' of linguists. Architects, like all visual oriented artists, create in a silent dialogue with their drawings and images. Therefore the content of DY*N*AMO's case base is primarily graphical. In order to enhance the comfort of use and avoid having to switch thinking modes between designing and consulting cases, a graphical interface has been designed and implemented.

3. Visual keys

The graphical interface is a collection of structured visual keys, covering most of the design categories that belong to the architect's vocabulary. In fact all together they represent a graphical codification of architecture, inspired by major architectural theoretical publications. The keys are presented as icons, and in order to guarantee an open system, a sketch tool has been built allowing users to create their own keys as shown in Figure 3. (Morisse, 2001).

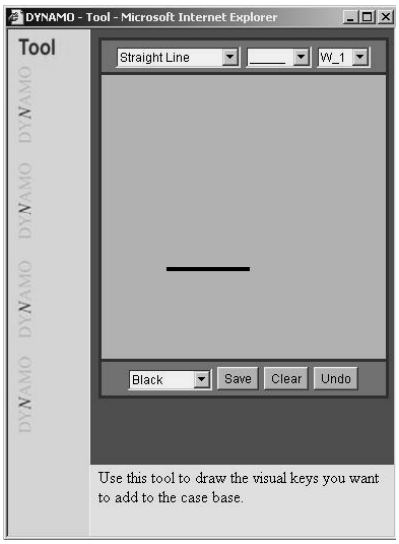


Figure 3: sketch tool to create visual keys.

However, because icons are not always univocal, a textbox pops up when hitting an icon. The visual keys provided by the system, as well as those added by the user, are linked to the database by their textual description that has to be input/assigned manually when creating a case. It is imaginable to automate this step by pattern recognition, but this has not been implemented. The keys have been structured along two major lines: first according to the Vitruvian tri-partition of architecture in Firmitas, Utilitas, Venustas (Rowland, 1999) plus the category Context and secondly, according to three levels of detail: the bigger scale or master plan at level 1, subsequently at level 2 the single building block and at the smallest scale the level 3 of individual rooms or spaces. These levels are based upon a general framework for CAAD, which spans the normal scope of architectural design as in Figure 4. (Neuckermans, 1992)

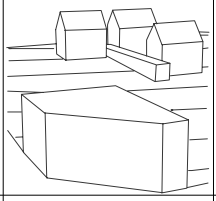
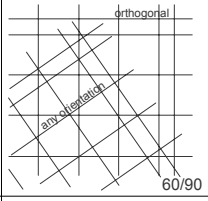
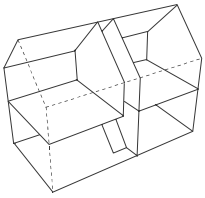
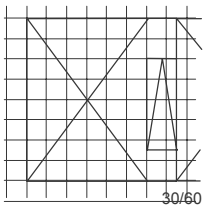
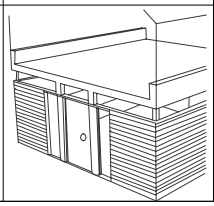
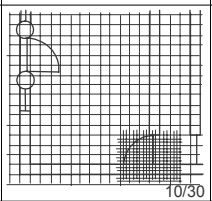
Building Program	Design Entities		Grids	Tests
	Name	Geometry and attributes	Topology and attributes	
Level 1 **MASTERPLAN**	∀ Basic building types ∀ Masterplan blocks ∀ Circulation axes ∀ Site contingencies			∀ Cost/m² or cost/m³ ∀ Surface/block ∀ Compactness ∀ Energy requirements ∀ Traffic ∀ Morphology ∀ Views and sights ∀ Shadowing
Level 2 **BLOCK or TYPE**	∀ Rooms or singular spaces			∀ Cost/m² based on ratios ∀ Surface and volume/space ∀ Temperature fluctuations ∀ Level of insulation ∀ Morphology
Level 3 **ROOM or SPACE**	Building elements: ∀ Wall ∀ Column ∀ Beam ∀ Arch ∀ Opening ∀ Door ∀ …			∀ Gross-nett surface/space ∀ Cost based on elements method ∀ Comfort prediction ∀ Daylighting ∀ Sunshining ∀ Morphology ∀ Elementary stability

Figure 4: A conceptual framework for CAAD, spanning 3 levels of detail: master plan, building block and room or space

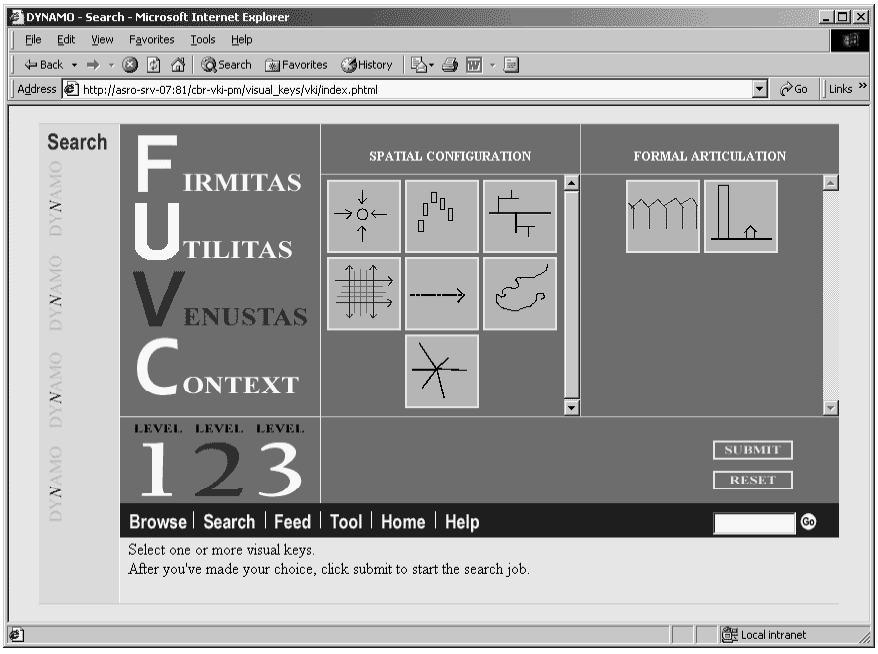
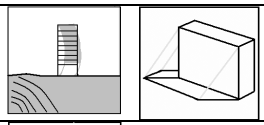
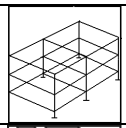
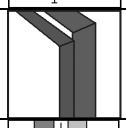
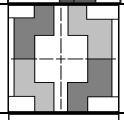
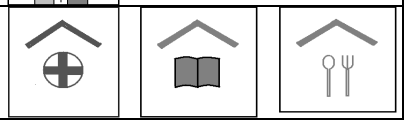


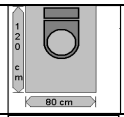
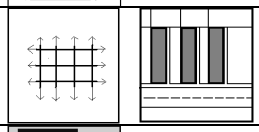
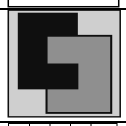
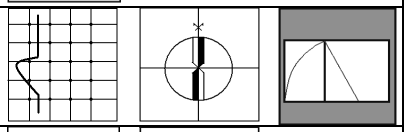
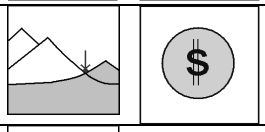
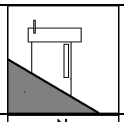
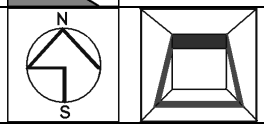
Figure 5 : example of DYNAMO's visual keys

Further refinements within each of these 12 categories (4 dimensions and 3 levels) have been inspired by the work of Christian Norberg-Schulz, Francis Ching, Rob Krier, Le Corbusier, Panerai and Castex, CI/SfB, Pierre von Meiss and others. From Genius Loci (Norberg-Schulz, 1980) we borrowed the idea of what makes a space a place. Norberg-Schulz identified 3 categories characterising a place: history, meaning and identity, from which in particular the last one serves our purpose. Identity, according to Norberg-Schulz, has to do with location, formal articulation, spatial configuration (see Figure 5). Icons for building programmes are inspired by those we made for BB/SfB, the national version of the CI/SfB building classification system that is widely used in Europe (De Troyer e.a., 1990).

'Architecture: Form, space and order ' by Ching (1978) still remains the seminal sourcebook on modern architectural composition and has inspired most of the icons describing the elements of architecture. The 'Elements of Architecture' by Rob Krier (1983) and the book of the same name by Von Meiss (1990) offer an interesting complement to that. From Le Corbusier and Jeanneret (1927) we borrowed the well-known icons of his 5 guidelines ('points') to a new architecture. As far as the graphical codification of urban spaces is concerned, Rob Krier's book (1979) provided us with a thesaurus of schemes derived from real cities. The books by Panerai and Castex (1997,1999) inspired us for the typology of urban block structures.

Table 1: visual keys' structure

Entry points		Textual descriptor	Iconic representation
Firmitas	Level 1	Seism Wind Insolation	
	Level 2	Skeleton Structural system Large span	
	Level 3	Building elements e.g. Cavity wall Materials	
Utilitas	Level 1	Public/private Open/closed Street/Square	
	Level 2	Building programmes e.g. hospitals	

	Level 3	Functions Activities Kitchen	
Venustas	Level 1	Grid Block - Ilôt Strip -'Barre'	
	Level 2	Types /Cluster Formal articulation	
	Level 3	Colour/Texture Symmetry Composition	
Context	Level 1	Landscape Climate Budget	
	Level 2	Site topography Microclimate Budget	
	Level 3	Orientation View Sunshine	

4. Summary and conclusion

In an attempt to fit better the architects' designerly way of thinking, we have developed a graphical user interface to access DY*N*AMO, an online collection of architectural cases. The software that has been developed, so far does not only allow users to access cases via visual keys we have implemented, but also provides a tool to sketch and submit their own keys.

Acknowledgement

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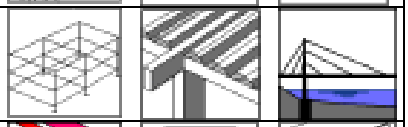
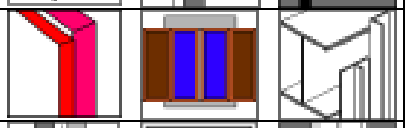
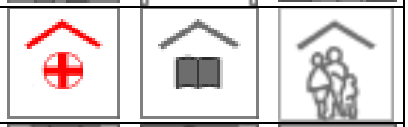
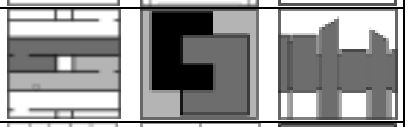
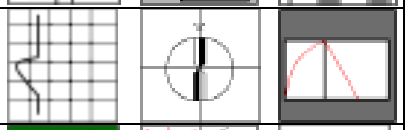
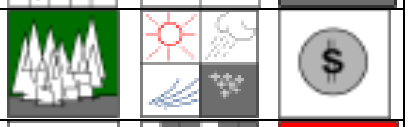
	Level 2	Skeleton Structural system Large span	
	Level 3	Building elements Wall / Window Materials	
Utilitas	Level 1	Public/private Open/closed Street/Square	
	Level 2	Building programmes e.g. hospitals	
	Level 3	Functions Activities Kitchen	
Venustas	Level 1	Grid Block - Ilôt Strip -'Barre'	
	Level 2	Types / Cluster Articulation	
	Level 3	Colour/Texture Symmetry Composition	
Context	Level 1	Landscape Climate Budget	
	Level 2	Location/topos Density Microclimate