The AIM@SHAPE Adventure: Mission and Results

Bianca Falcidieno*
Project Coordinator
falcidieno@ge.imati.cnr.it

***Abstract*— During the period $2004 - 07$, the AIM@SHAPE Network of Excellence has fostered the development of new methodologies for modelling and processing the knowledge related to digital shapes. This knowledge is concerned with the geometry (the spatial extent of the object), the structure (object features and part-whole decomposition), the attributes (colors, textures), the semantics (meaning, purpose), and the evolution with time (morphing, animation) of digital shapes.**

In this poster contribution, we will present the idea behind the AIM@SHAPE approach and discuss the achieved results, with a special emphasis on the the definition of a common framework for formalizing, processing, and sharing the shape knowledge through an e-Science framework.

For the demo session, we will present interactive demos of the AIM@SHAPE Digital Shape Workbench.

I. The new dimension of content: digital shapes

The field of Shape Modelling concerns methods to represent, create, process, and analyze digital representations of objects, which are basically multidimensional media characterized by a visual appearance. The resources coming from this field and the related applications are likely to emerge in the multimedia landscape, where storing and retrieval issues are already important subject of study for the scientific community.

In the digital representation of shapes often a huge amount of information is necessary. Examples of shapes are pictures, sketches, images, 3D models of solid objects, video, 4D (3D+Time) animations. Especially if the described shape is a 3D object, the representation of its boundary or volume often requires several MegaBytes (sometimes even GigaBytes for very accurate representations). Since shapes are usually embedded in contexts, depending on the specific application, the user can be interested in the actual geometry of the shape (e.g. for analytic purposes, for appreciating the details), just in its structural description (e.g. for topological considerations, for retrieval of articulated objects), in an interpretation of it (e.g. for semantic considerations, for classification), or maybe just in a "plain" description based on the Dublin Core Metadata Element Set. Furthermore, there is no unique way to describe a shape, and different views on the same item have to be maintained.

Shapes are not the only relevant resource in the Shape Modelling field. The software tools with which the shapes are handled, created and transformed are themselves important resources to deal with. Moreover, some important information related to the shapes cannot be stored within the shapes themselves. For example, information on the owner, on how the shape was acquired, on what is its creation history, or on some other domain-specific characterization is not included in the representation of the shapes. Nevertheless, this information can enrich significantly the informative power about the resources.

II. The AIM@SHAPE mission and results

In this context, the FP6 Network of Excellence AIM@SHAPE is pursuing the introduction of *Knowledge Management techniques* in Shape Modelling through (a) the definition of a framework, which is able to support different shape representations and tasks related to the *Shape Lyfecyfle*; and (b) its implementation in a technological platform, which is called the *Digital Shape Workbench*.

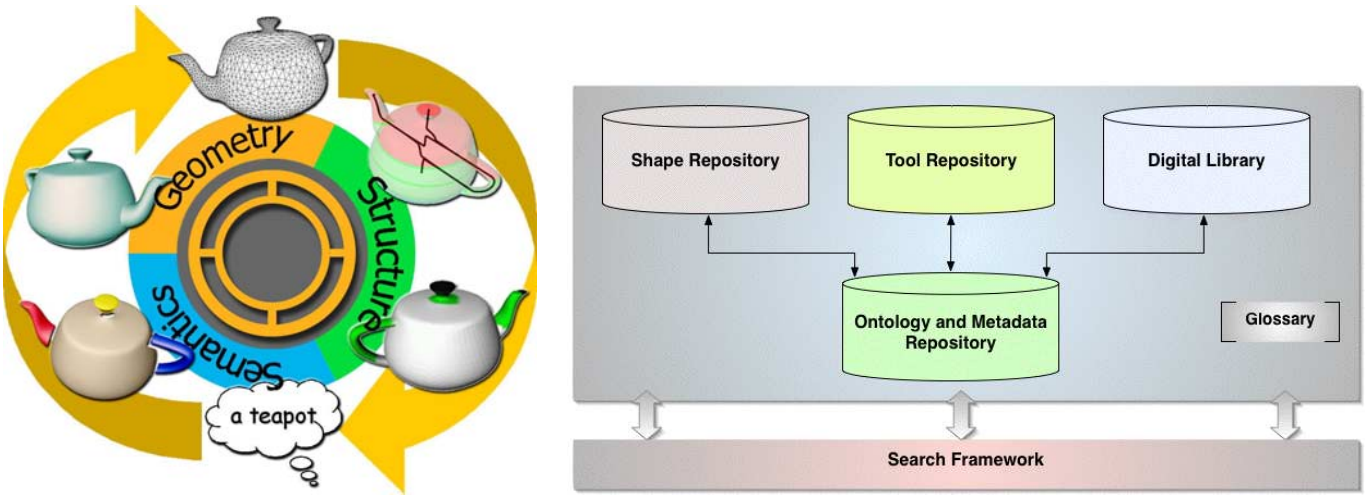
A shared and modular conceptualization is performed by describing and documenting the shapes throughout their creation and usage lifecycles (see Figure 1(a)). The core of the integration pursued by AIM@SHAPE resides in the homogenisation of the approach to modelling shapes and their associated semantics using knowledge formalization mechanisms, in particular metadata and ontologies, which describe shape models and processing tools and provide the rules for linking semantics to shape or shape parts.

Among many distinct areas of specialization of Computer Graphics and Vision, AIM@SHAPE focuses on *Virtual Humans*, *Product Design*, and *Shape Acquisition and Processing*. Each domain of interest has lead to the development of an ontology that describes research and knowledge in a particular area of Shape Modelling. The need for general metadata for shapes and tools lead to the creation of higher-level ontologies which constitute the common ontologies to be shared, reused and extended by the specific domain ontologies. Keeping the common ontologies structure simple is a vital prerequisite for ensuring their reusability. The ontologies developed by AIM@SHAPE are publicly available at the project web portal[1].

As already mentioned, the information about the different aspects of shapes and related resources need to be kept separated for modularity's sake, but still live in an interconnected framework, which is represented by the Digital Shape Workbench (DSW, for short) [2]. As summarized in Figure 1(b), the DSW does not store only shapes but all the information that is involved in Shape Modelling tasks and helps the user to gain a deeper insight on the selected resources. Therefore, the DSW is a common framework, which stores and retrieves shapes, tools, publications, as well as the knowledge related to them. In particular it is composed by separated repositories for

*This work has been done with the contribution of the AIM@SHAPE Partners.

[1] http:www.aimatshape.net
[2] http://dsw.aimatshape.net/



(a) (b)

Fig. 1. (a) The AIM@SHAPE lyfecycle and (b) the Digital Shape Workbench Infrastructure.

different kind of resources, which rely on a conceptualization of the domain achieved through the development of domain ontologies. The purpose of this conceptualization is twofold: on one hand, it offers to the different sub-domains afferent to Shape Modelling a unique and shared understanding of the domain, and on the other hand it offers the possibility of exploiting reasoning facilities on it.

The *DSW infrastructure* consists of the data repositories (for shapes and tools), a knowledge management system that handles metadata and a number of different ways of discovering, searching and browsing resources. The basic functional requirements of the DSW are:

- uploading of shape models, tools, bibliographic references and their corresponding metadata according to the ontologies developed by the consortium;
- downloading of resources;
- browsing and searching for resources;
- metadata management activities (e.g. editing, deleting metadata about the resources).

The DSW is intended to be used mainly by expert users to find quality shape models meeting specific criteria, publications related to them and tools applicable to them, to search for literature related to specific topics; to discover commonly used shape models for testing and comparison, large scale models to test the applicability of their methods on real-world data, or new and original models.

In particular, the *Shape Repository* [3] is a shared repository populated with a collection of digital shapes. Its primary goal is to include a variety of standard test cases and benchmarks, enabling efficient prototyping as well as practical evaluation on real-world or large-scale models.

The *Tool Repository* [4] is an inventory of shared software tools that can be used in different stages of digital shape processing. It mainly contains existing tools, already developed by the project Partners. It also combines, adapts, and enhances tools developed by different research teams. In addition, the Tool Repository includes a brief specification of the tools usage, limits and capabilities as metadata.

The *Digital Library* [5] is a common repository of scientific references and technical reports which integrate the bibliographies of the participating Institutes.

The *Ontology and Metadata Repository* [6] [7] constitutes the knowledge base back-end where all domain-specific as well as the more general knowledge, common to the various domains, is stored. The aim is to represent and collect shape knowledge that can be effectively used by real applications and tools.

During the session, live demos and presentations about the most important results of the NoE will be given by the AIM@SHAPE Partners.

ACKNOWLEDGMENTS

This work has been supported by the ECFP6 IST NoE 506766 AIM@SHAPE and done with the contribution of the AIM@SHAPE Partners:

1) CNR-IMATI, *Italy*;
2) DISI, *Italy*;
3) IGD, *Germany*;
4) EPFL-Vrlab, *Switzerland*;
5) INPG, *France*;
6) INRIA, *France*;
7) ITI-CERTH, *Greece*;
8) MPII, *Germany*;
9) SINTEF, *Norway*;
10) TECHNION, *Israel*;
11) UNIGE, *Switzerland*;
12) UU, *Netherlands*;
13) WEIZMANN, *Israel*.

[3] http:shapes.aimatshape.net
[4] http://dsw.aimatshape.net/tools/
[5] http://dl.aimatshape.net/aim@shape/insert/nuovaGUI1.0/
[6] http://dsw.aimatshape.net/ontologies/
[7] http://dsw.aimatshape.net/glossary/