Demonstration of DALEST-Elica Educational Software

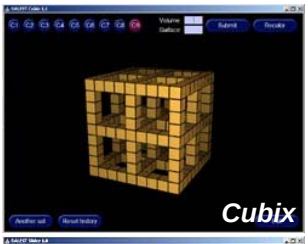
Pavel Boytchev

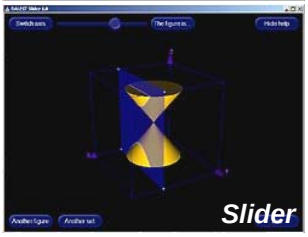
Dept. of Information Technologies
Faculty of Mathematics & Informatics
University of Sofia
5, James Bourchier blvd
1164 Sofia
Bulgaria
elica@fmi.uni-sofia.bg

Abstract. The goal of the DALEST project is to develop dynamic three dimensional software suitable for the teaching of Stereometry. Some of the DALEST applications will be based on Elica. The demonstrated DALEST-Elica applications explore objects, relations and ideas from Stereometry in an attractive visually-oriented manner.

DALEST-Elica Applications

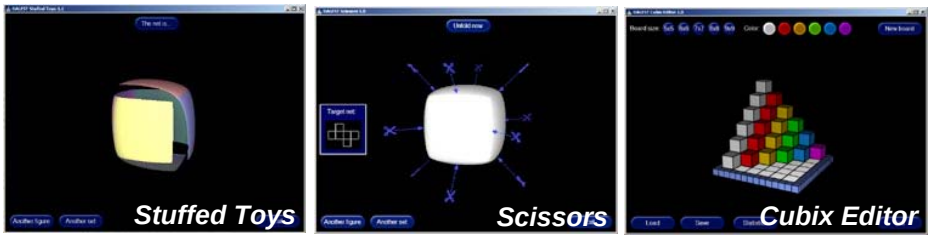
This demonstration presents current work done under the DALEST (Developing Active Learning Environment for Stereometry) project. Partners in the DALEST project are: University of Cyprus, University of Southampton, University of Lisbon, University of Sofia (DALEST/Elica Project), University of Athens, N.K.M Netmasters and Cyprus Mathematics Teachers Association. The project is co-funded by the European Union under the Socrates Program, MINERVA, 2005 Selection. The applications which are presented are based on Elica - a free development environment with its own programming language. The applications are used to practice measuring of volume and surface of 3D solids, exploring various intersections of solids and planes, as well as playing with the reverse problems of well known nets problems.





The **Cubix application** visualizes a 3D cubic structure made of unit-sized cubes. By examining it from different points of view the students must calculate, count or guess the number of cubes used and the surface of the structure. There are several sets of problems ranging from the easiest structure (made of 1 cube) to complex solids as the one shown in the snapshot.

The **Slider application** creates an invisible 3D solid (a cube, sphere, cone, etc.) which can be cut through with a magic plane. Only the intersection becomes visible. By moving and rotating the cutting plane students are supposed to analyze the changes in the intersection and find out the solid. Solids can have



various orientations and can be made visible - a feature which helps students to understand how an object can "produce" various intersections.

In the **Stuffed Toys application** a set of toys all made of 6 faces are ripped off in a random way. The students have to guess what net will be produced after unfolding but without actually unfolding the toy, i.e. they should unfold it mentally and then select the proper shape from a dialog window. There are two sets of toys – simple cubes and colored toys like balls, octahedrons, eggs, pebbles, etc.

In the **Scissors application** students have to solve the reversed problem of net folding - they have a cube and must decide which edges to rip off, so that the remaining figure can be unfolded into a predefined net. Except for the cube and all toys from Stuffed Toys, this activity has a third more complex set, which can be used to master highly abstract mental visualizations.

The **Cubix Editor application** is used by students to create 3D solids built of unit-sized cubes. Such solids can be used by the Cubix and the Cubix Shadow applications. The Cubix Editor allows the students to save their structures and reload them, thus making a library of various figures. The application comes with a small set of predefined figures.

In the **Cubix Shadow** application a cubic composition made of unit-sized cubes casts shadows on the OXY, OYZ and OZX planes. The problem is to recover the composition by examining its three silhouettes (the projections on the three coordinate planes). Some problems provide extra challenge – they are a 3D variant of the “8-Queens” chess problem.

The **Potter's Wheel application** shows a simple 2D object rotated in 3D around a vertical axis and thus generating various 3D rotational objects. This application provides a design tool where students can experiment with various cases. They use only few simple 2D objects, but varying their position and orientation relative to the axis, it is possible to generate many different 3D shapes.

The **Origami Nets application** makes it possible to build nets using triangles, squares, rectangles, and regular polygons, and then define folding angles. In this way it is possible to experiment with different nets of various 3D solid. The application allows the smooth transition from 2D flat net to 3D folded net. Adding new elements to the net is done interactively. It is also possible to create chain of rectangles or triangles which fold into a cylinder or a cone.