

## **ENGINO**

### **Increasing the creativity of ENGINO toy sets and generating automatic building instructions**

[ENGINO.NET LTD](#) was founded by Costas Sisamos in 2004 in order to commercialize his invention of a new system of multi-functional plastic connectors. After successfully receiving research funding, Costas left his full-time job as an educator to fully engage in R&D, and after 3 years of designing, prototyping and testing, in 2007 he launched the first sets of ENGINO® construction toys. The ENGINO toys are created by assembling small pieces together, with the purpose of helping pupils build technological models creatively and easily so that they can experiment and learn about science and technology in a playful way. The products grasped the attention of global buyers and toy experts and by now more than 60 different toy sets are manufactured in his production facility in Limassol, covering various age levels and price ranges, from simple sets to solar energy and robotics. The company has experienced steady growth, reaching presence in more than 40 countries by now.

#### **The company has identified the following challenges for the Study Group:**

Each of the 60 toy sets has a specific number of elements that can be assembled into many different models. We have found out through our extensive model building that the creative potential of the system increases geometrically as the number of parts in the set increase. This is due to the patented design of the ENGINO parts that allow connectivity from many directions simultaneously. As of that, the “value for money” for ENGINO is much higher than the competition when the number of parts used correspond to a retail value of the product around 25 euro, which is equivalent to around 70 parts. For smaller sets, the competition seems to offer better value due to having smaller components and more specialized parts that add to the aesthetics and functionality. The moto of the company is “Play to Invent”, with creativity being the number one driving factor of the product offering. Hence, most of the ENGINO products are designed to maximize the number of models per set, leading to packages from “4 models in 1” to “120 in 1”. What we would like to know is how can this creativity level be quantified and measured as related to the number and type of parts and how this can compared with an equivalent system’s generic parts such those of LEGO Technic. Having this “creativity measure” we can then know if the sets have indeed been optimized or if more models are also possible. Also, by substituting some parts with others maybe the level of creativity can be increased. Furthermore it will provide a marketing tool to explain the creativity of the system.

Another big challenge for the company is to be able to generate the assembly instructions for each toy **automatically**. For most of the toy sets the instructions are currently being created manually. The developers attempted to create an automatic disassembly module in a proprietary 3D builder software which is based on the [UNITY 3D-Game Engine](#). However, the system cannot predict which part needs to be connected first during the assembly instructions. The priority of parts is random and incorrect, making the generated instructions not usable. For

example, if you build a square and you need to insert a diagonal it is not possible to do it after you build a closed loop. The diagonal should be connected first while the structure is open and elastic and then closed to a rigid frame. It is important to find a solution to this problem and have an algorithm that will be able to prioritize the different parts of the structure or substructure, which we can feed in the software so that we shall optimize the de-structuring of a model with physically correct priority sequence. There may be endless possibilities that can work so a solution may seem impossible, however there some solutions that definitely will not work and those are the ones we need to be able to identify and remove from the possible assembly sequence.