MALAG: a discursive grammar interpreter for the online generation of mass customized housing

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MALAG is a discursive grammar interpreter for the generation of mass customized housing online. (Duarte 2005) MALAG is composed of two modules: PROGRAMA and DESIGNA. PROGRAMA is a description grammar interpreter that based on user and site data generates the design brief, that is, a symbolic description of an adequate house design that satisfies the Portuguese housing regulations. During the generation the user is presented with a GUI controlled by the description grammar so that the user options are restricted according to his previous choices in order to avoid errors (Fig. 1 and 2). PROGRAMA is written in Java, encoding the rules with Jess - a rule engine for the Java platform. The application is deployed as an applet running on the user's browser. The output is a text file with the design brief. Information on this implementation can be found in (Duarte and Correia, 2005). From this design brief, the second module, DESIGNA, computes a set of designs according to some architectural style. To this end, DESIGNA uses both a description grammar and a shape grammar. The shape grammar implementation is based on the work of Heisserman (1991) regarding logical reasoning about solids using first-order logic. We encode the shape grammar rules using Jess and we use the Jess-based reasoner to select and apply the shape rules. To implement both the geometry of the solids as well as the shape manipulation process, we use CGAL, an efficient library of algorithms and data-structures for problem solving in the geometry field. Given that MALAG is mainly developed in Java, we wrapped CGAL's graph-based boundary representation of solids in a Java library, thus allowing Jess rules to match and operate on CGAL's solid models. In order to visualize the generated geometries, we plan to use HTML5 capabilities, in particular, the WebGL-capable canvas element. This will allow the user to have immediate visual feedback so that he/she

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can evaluate the generated house model and, if necessary, to change the data provided previously, thus allowing an interactive loop where different house models are generated until the user is satisfied with the result.

References:

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Duarte, J.P.; R. Correia Implementing a Description Grammar for Generating Housing Programs Online, in *Construction Innovation Journal on Information and knowledge Management in Construction*, volume 6, nº 4, December 2006, pp. 203-216, Emerald Group Publishing.

Heisserman (1991) Generative Geometric Design and Boundary Solid Grammar. Ph.D. Dissertation. Carnegie-Mellon University, Department of Architecture.

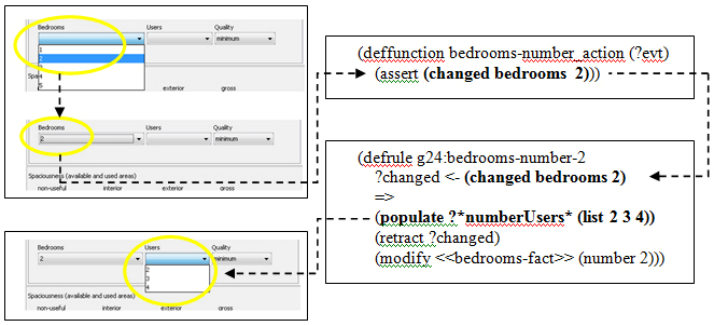

Fig. 1 Example of the information flow between the GUI and the grammar rules

Fig. 2 PROGRAMA GUI

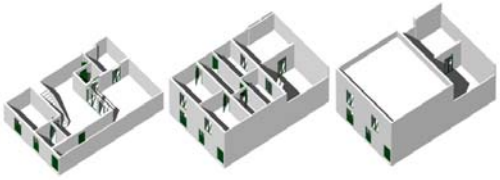

Fig. 3 Example generate (by hand) of the shape grammar