The Prototype of Design Product Knowledge Representing System

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Abstract: The purpose of this position paper is to introduce the prototype of a design product knowledge representing system which is theoretically guided by our recent work on extending Function-Behaviour-Structure ontology. The basic constructions and data-storing strategies are presented in the paper along with its major interface, thus to give an outline of the working pattern of this system.

1 Background

To represent those design products information, they must firstly be categorized into different classes within each of which same feature can be concluded. One of the most influential design ontologies is the Function-Behaviour-Structure (FBS) framework [GK04]. Despite of being widely adopted, the controversies about FBS theory were just as intense as its popularity in the latest decade, especially with the intricate definitions of key concepts [Ve13]. In our former research we introduced the object perception principles of cognitive psychology [SK07] to the design theory field. By taking this new approach, it is suggested that all the object systems are dominated by a common tree-like topology, and the Function, Behaviour and Structure of any object node in the treemap are hence interpreted as the relationships between it and its encompassing system, interacting objects and internal components, respectively. And the design system presented in this paper is thus developed to verify our theory. As design products information provide the knowledge framework for the design projects and link the variety of design activities, applying this system in design practise can visualize different design information and guide the progressing of design project. Furthermore, the classification of products information means that the design practice, which contains various procedures mapping from one kind of product description to another, are modularized. And with the standardized interfaces, the variety of design tools can be integrated as parts of the system.

2 The System

Based on our extending work on FBS ontology, a new design knowledge representing system is suggested. Within the system, a treemap of the design product is generated and the variety of design products information are represented as textual strings and allocated to each not of the tree. All data are stored in server which can be accessed by and the designers/engineers with webpage browser. The treemap will serve as a draft of the design product descriptions and guide the designers and engineers going through different design steps, like formulation, synthesis, evaluation, etc. Various design tools, such as geometric modellers, FEM calculators, optimizers, etc., can also connect to the system via web services, and take the design product describing information as the import or export data of their calculating cycle. The network-based construct allows parallel processing and real-time information exchanging among multiple human users and/or calculating units.

The major human interface of the system contains four functional areas. The Scenes area lists all the environments that the design product is involved. The Topology area lists all the objects in every granularity and organized them in the boundary-based treemap. The main screen displays all the entities and descriptions concerned in the design cases, include objects, interactions, roles, composing relationships, etc., and focus on the object which the user is currently working with. And the geometry model of that object is displayed in Model area.

All data are stored in relational database. Two most important classes in the system are Object and Interaction. Both involved in a designing scene are saved in the same table, with each instance occupying one row and attributes in columns. The operations of Object provide the data port for various design activities to be docked in, such as the design steps introduced in original and situated FBS frameworks including Formulation, Synthesis, Analysis and Evaluation, and also the Decomposition and Initialization which is suggested in our newly proposed nested FBS framework (in press). These activities can be either manual or software-centred. The classes diagram are depicted in Unified Modelling Language (UML).

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