A Controlled Experiment for Selecting Transformations based on Quality Attributes in the context of MDA

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Abstract
In this paper, we briefly introduce a controlled experiment to investigate the selection of alternative transformation rules through which to obtain UML class diagrams from a Requirements Model [2]. The main goal of this experiment was to determine which of the transformation rules for structural relationships between classes (association (A1), aggregation (A2) and association class (A3)) produces the UML class diagram that is easiest to understand. More details about the transformations and about the experiment are provided in [1]. We focus upon the understandability of UML class diagrams because it is well recognized that if a model is easier to understand it will be easier to maintain, reuse, etc.

1. Experiment description

Subjects: 39 fourth-year students in Computer Science at the University of Technology of Valencia, Spain.
Variables: The independent variables were the transformation rules for structural relationships between classes (A1, A2, A3). The dependent variable was understandability.
Experimental material: 9 Sequence Diagrams from three different case studies, with 3 UML class diagrams in each. These were obtained by applying the alternative transformation rules. The experimental material is available at: www.dsic.upv.es/~einsfran/experiment. Each of the three UML class diagrams had a questionnaire attached (with 6 questions) in order to assess which alternative UML class diagram was better understood by the subjects. Three measures of the dependent variable were obtained: Understandability Time, Understandability Effectiveness and Understandability Efficiency.

Hypothesis: $H_{10}$: The use of different alternative transformations (A1, A2, A3) does not affect the Understandability Time ($A_{1TIME}, A_{2TIME}, A_{3TIME}$). Analogously, we formulated the $H_{20}$ and $H_{30}$ for Understandability Effectiveness and Efficiency, respectively.

2. Conclusions and future work

The results show that there is a slight tendency towards favoring the use of association relationships. This means that the subjects are slightly more effective and efficient when understanding the class diagrams obtained through the transformations based on associations. A reason for this could be that this relationship has less semantic strength than the other kinds of relationships. When an aggregation relationship is chosen instead of an association relationship, analysts know that they are defining a part-of relationship. From a practical point of view, this experiment provided empirical evidence about which alternative transformation produces the UML class diagram that is the easiest to understand. Our intention is to use this evidence to drive an automated transformation process. We plan to replicate this experiment with more experienced students and also with practitioners.

References