On the Effectiveness of UML Sequence Diagrams in the Comprehension of Functional Requirements

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Abstract. Modeling is a fundamental activity within the requirements engineering process and concerns the construction of abstract descriptions of requirements that are amenable to interpretation and validation. Empirical evidence about which modeling technique helps to improve the comprehension of functional requirements is needed. This paper presents the results of a family of experiments conducted with students and professionals to investigate whether the comprehension of functional requirements is influenced by the use of dynamic models that are represented by means of UML sequence diagrams. The family contains five experiments performed in different locations and with 112 participants of different abilities and levels of experience with UML. The results show that sequence diagrams improve the comprehension of functional requirements in the case of high ability and more experienced participants.

Keywords: UML sequence diagrams, comprehension, family of experiments.

1 Introduction

Requirements validation is the task of making sufficient empirical observations to verify whether a real world problem is properly captured. To assess this fact, we should verify that the associated models are properly interpreted and understood by stakeholders. An incorrect interpretation and comprehension of models would increase the cost needed to fix them later in the development process.

Several approaches for representing functional requirements have been proposed in the past, and of these, behavioral modeling is a common part of those most widely employed. Behavioral modeling involves the modeling of the dynamic and/or functional behavior of software systems. However, does the knowledge about the dynamic behavior of systems (represented by UML Sequence diagrams) help the stakeholders with different level of experience and abilities with UML to better comprehend functional requirements? This question was investigated through a family of experiments.

2 The Family of Experiments

Fig. 1 presents the roadmap of the family of experiments carried out to verify if the use of dynamic models, represented by UML sequence diagrams, improves the comprehension of the modeled functional requirements. It includes information about the number and type of subjects, experimental objects and location of the empirical study.

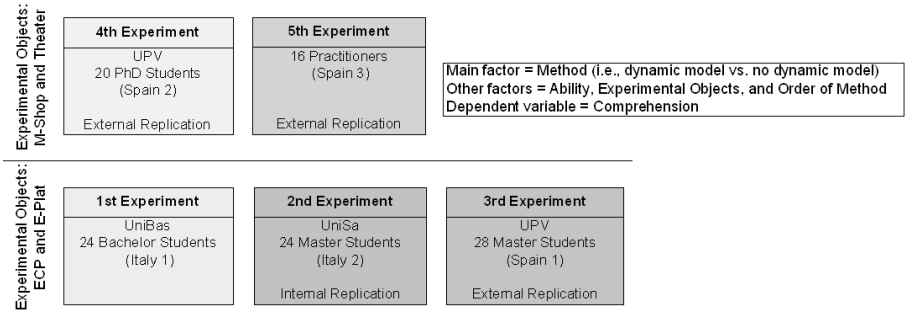

Fig. 1. Family of experiments roadmap

We expected that the stakeholders' comprehension of the models would increase when they are provided with additional behavioral information (sequence diagrams in our case). However, stakeholders' ability and experience with UML, and the way in which the sequence diagrams are built (e.g., the level of detail and the use of complex functionality of the notation), may affect their comprehension of the requirements. Therefore, here we are interested in investigating whether the comprehension is affected by the stakeholders' ability and experience; along with whether there is some interaction between the participants' ability and the main factor under study. To evaluate the participants' comprehension of the models, we assessed the answers they provided to a comprehension questionnaire in terms of correctness and completeness.

3 Conclusions

The results obtained show that i) dynamic models represented in terms of UML sequence diagrams improve the comprehension of functional requirements; ii) some experience is needed to benefit from sequence diagrams; iii) high ability participants benefit more than low ability ones from the use of sequence diagrams; iv) the familiarity with the modeling method used to abstract the requirements might affect the comprehension. Further investigations include empirical studies involving different behavioral models and groups of professionals with different levels of experience with UML.

References

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