

Chapter 21

Conceptual Experiments in Automated Designing

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ABSTRACT

The success of designing Software Intensive Systems (SIS) and other objects may be improved by incorporating conceptual experimentation to be part of the design process. This paper presents a scientific approach to conceptual experimenting with objects that are units of designers' behavior and is aimed at solving project tasks in conceptual design. The proposed approach is based on specifying the behavior units as precedents and pseudo-code programming of experiments' plans. Reasoning used by designers in the experiments is registered in a question-answer form. Experimenting is supported by a specialized toolkit.

INTRODUCTION

Five years ago, the group of well-known researchers and developers in software engineering had initiated a process of innovations, which have been named SEMAT (Software Engineering Methods And Theory). The main reason for this initiative was *an extremely low degree of success in developments of Software-Intensive Systems*. Last twenty years, this problem is steadily registered in statistics (success approximately in 35% of cases) that are presented in reports (Chaos, 2013) of the company “Standish Group.”

It is necessary to notice that, in normative documents of SEMAT, a way of working used by a team of designers is marked as a very important essence (Jacobson, 2012). There “way-of-working” as a notion is defined as “the tailored set of practices and tools used by the team to guide and support their work.” Also, the specification “tailored” indicates that designers of any SIS should choose and apply appropriate means in accordance with situations arising in real-time. By other words, designers have to build and use the technology of their work in the design process. Therefore, investigations aimed at the search of effective ways-of-working are perspective and can lead to an increase of success in developments of SISs.

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Told above suggests that designers should have an opportunity for real-time interactions with “libraries” of practices and tools and their units. Such interactions have to support creating and using the technology $T(t)$ of working that is based on the accessible experience applied by designers.

We are deeply convinced that the efficiency of ways-of-working can be greatly enhanced by increasing the efficiency of interactions with the experience in the process of solving the project tasks. The basis of this conviction is our research of the place and role of experience at the conceptual stage of designing the SISs. It should be noted that this stage is estimated as an inevitable source of costly mistakes due to the problem of personal and collective understanding.

Our research interests have concerned real-time interactions of designers with their natural experience and its models in collaborative designing. The main result of the research is the question-answer approach (QA-approach) to conceptual designing that is oriented on the constructive use of question-answer reasoning (QA-reasoning) for interactions with the experience at this stage of actions. Investigations of interactions of this kind have led us to the development of an instrumentally-simulation environment WIQA (Working In Questions and Answers) and a corresponding system of workflows “Interactions with Experience” (Sosnin, 2013 a).

It should be noted that reports of Standish Group were “guides” for planning of our research, applying of QA-approach and evolving of the toolkit WIQA and workflows “Interactions with Experience.” Step by step the QA-approach concerns criteria and factors that facilitate increasing the degree of the success in designing of SISs.

This paper presents a step of a research that focuses on interactions with the accessible experience in conceptual experimenting of designers in the work with project tasks being solved. A conceptual experiment is understood below as a thought experiment, the content and process of which are operatively reflected on a semantic memory of a question-answer type, and results of reflections are applied in the process of experimenting with useful purposes. Conceptual experiments are similar to automated thought experiments.

BACKGROUND OF INTERACTIONS WITH EXPERIENCE

Naturally-Occupational Experience of Designing

Any modern SIS is developed with the use of the accessible experience E^A a part of which is accumulated in specialized standards. Such sources of experience help to decrease the level of complexity in interactions of designers with the system that is otherwise not constructed. For example, at any step of the conceptual stage of designing, a number of standards helps to simplify the work with the SIS that exists in a form of a system of conceptual models M created by a team of designers in a collaborative development environment. An important subset of these models and corresponding technological practices can be inherited from the following standards:

1. Capability Maturity Models Integrated for Developing (CMMI, version 1.3, about five hundred practices) that offers not only an important subset of best practices for process P of designing but also prescribes the ways for its continuous improving;

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