

# On the Appropriate Rationale for Using Design Patterns and Pattern Documentation

Zoya Durdik, Ralf H. Reussner

Institute for Program Structures and Data Organization  
Karlsruhe Institute of Technology (KIT)  
76131 Karlsruhe, Germany  
zoya.durdik@kit.edu  
ralf.reussner@kit.edu

**Abstract:** Software design patterns are proven solutions for recurring design problems. Therefore, one could expect that decisions to use patterns are beneficial and well documented in practice. However, our survey showed that 90% of the software engineers have encountered problems while applying patterns, understanding applied patterns or with their documentation. We address these problems in our paper “On the Appropriate Rationale for Using Design Patterns and Pattern Documentation” published at the “Quality of Software Architecture 2013 (QoSA)” conference. There we present an approach based on a new type of pattern catalogue enriched with question annotations, and the results of a survey with 21 software engineers as a validation of our idea and of exemplary entries of the pattern catalogue.

## 1 Short summary

Software design patterns are proven and widely used solutions for recurring design problems. However, there are several problems connected to the application of patterns, the modification of applied patterns and the documentation of decisions on pattern application. This is also confirmed by 90% of the academic and industrial software engineers who participated in our survey.

Some of the reasons why the use of design patterns is problematic and decisions on their usage are not well documented are: An overly intuitive application of design patterns, the lack of a standard to document design decisions on pattern application, and a burden of documentation effort, in particular when designs are informal and unstable in an early phase of software design.

In our paper “On the Appropriate Rationale for Using Design Patterns and Pattern Documentation” published at the “Quality of Software Architecture 2013 (QoSA)” conference [DR13] we analyse these problems and present an approach to address them. The approach supports the decisions on the appropriate use of design patterns, and the documentation of such decisions together with their rationale.

The approach we propose is based on a pattern catalogue. The major difference to other patterns catalogues is the inclusion of generic question annotations to each pattern to eval-

uate and to document decisions on the use of a pattern. However, the pattern catalogue is not intended to be used as an expert system. Instead, when answering the general questions to a pattern, software engineers learn whether the use of a pattern is appropriate for the specific design problem they are working on. They semi-automatically generate rationale, which is then saved to explain the engineer's decision to apply or to discard a pattern. As answers to the questions stem from requirements, the relevant requirements are linked to a decision. Further more, if a question cannot be answered with existing requirements, the requirements elicitation can be driven by architectural design in pinpointing to needed requirements to justify architectural decisions.

The envisioned benefits of the approach are a more appropriate use of design patterns and pattern variants even by less experienced software engineers, and documented design decision on the use of patterns with semi-automated documentation of their rationale with positive effects on evolution. In addition, trace links from requirements to design decision rationales and from there to the concerned architectural elements are automatically generated and documented, which further helps in system evolution.

Furthermore, in [DR13] we present the results of a survey with 21 software engineers as a validation of the idea and of some entries of the proposed pattern catalogue. The results of the survey can be summarized as follows: About 90% of the survey participants have encountered problems while applying patterns, understanding the applied patterns or their documentation. About 90% of the participants estimated that the proposed approach can be helpful to solve one or several of the encountered problems. In particular, 71% were positive that the pattern catalogue could help clarifying properties and consequences of a pattern, and 52% were positive about it to solve documentation problems, if answers to the pattern questions are automatically co-documented. The provided question annotations were considered understandable in about 95% in average for the listed sample patterns. This means that even if the pattern questions are general and project-independent, they can be answered by engineers in their project-specific situations.

The opinions of the participants may be subjective, however, the results of the survey provide a positive and valuable indication on the potential usefulness of such a catalogue. More details on the proposed approach and on the survey are provided in the [DR13].

## Acknowledgements

This work was partially supported by the DFG (German Research Foundation) under the Priority Programme SPP1593: Design For Future – Managed Software Evolution.

## References

- [DR13] Zoya Durdik and Ralf Reussner. On the Appropriate Rationale for Using Design Patterns and Pattern Documentation. In *Proceedings of the 9th ACM SIGSOFT International Conference on the Quality of Software Architectures (QoSA 2013)*, pages 107–116, June 2013.