

Measuring Object-Oriented Design Principles: The Results of Focus Group-Based Research

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Abstract: This work was published in the **Journal of Systems and Software**, Volume 140, **June 2018**, Pages 74-90, doi.org/10.1016/j.jss.2018.03.002. Object-oriented design principles are fundamental concepts that foster the development of software-intensive systems with a focus on good design quality. The aim of this paper is to examine the relationship between design best practices and 10 selected design principles. This should provide evidence whether the key design aspects of the design principles are covered. We conducted focus group research with six focus groups and 31 participants in total. Each group discussed five design principles and assessed the coverage by using the Delphi method. The result reveals the impact of each design best practice to the design principle and shows that the main design aspects of the design principles are covered by our approach.

Keywords: design best practices; design rules; design principles; software design quality

1 Introduction and Research Design

In previous work [Pl16a], [Pl16b] and [Br17] we have gained evidence on the importance of design knowledge-carrying concepts (design best practices and design principles) and the findings met our expectations. However, the important and remaining question is whether the proposed design best practices for a specific design principle cover the essential aspects of the principle or just touch on some minor design aspects. To answer this general question, we derived following research questions: *RQ1*: How important are design best practices concerning their assigned design principle? *RQ2*: Are there additional design best practices for operationalizing a design principle? *RQ3*: To what extent can the design knowledge of a design principle be grasped by the associated design best practices?

To answer the research questions, participants need to understand the concept and characteristics of each design principle. Further, they may have questions about some aspects that need to be clarified. With a solid understanding of the design principle, it is possible to judge whether design best practices are related to a design principle. According to these circumstances, we decided to conduct focus group research. The entire design of the research method and its combination with Delphi as a data collection method is aligned with the guidance given by [KBL08].

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2 Results

For *RQ1* we assessed 10 design principles and their design best practices. The ten principles are: Single responsibility principle (SRP), Information hiding principle (IHI), Don't repeat yourself (DRY), Open closed principle (OCP), Acyclic dependency principle (ADP), Interface segregation principle (ISP), Favor composition over inheritance (FCOI), Command query separation (CQS), Common closure principle (CCP), and Program to an interface, not an implementation (PINI). Except for OCP, the research reveals that the other nine principles have at least one design best practice, which has high or very high importance. In other words, those design best practices assessed as very high or high meet the design aspect of the principle. This provides a first justification that practices express certain parts of the associated design principles. In the context of answering *RQ2*, the participants of our study suggested additional 34 design best practices for our 10 design principles. Some of these suggestions, e.g. the design best practice *UseMeaningfulVariableNames* cannot be implemented with classical static code analysis. For *RQ3* the participants of the study rated the completeness of the design best practices. Table 1 gives an overview of the results.

Tab. 1: Average completeness of the design best practices

DP	Mean	Std. Dev. in Points	DP	Mean	Std. Dev. in Points
IHI	66	14	DRY	65	14
SRP	58	17	ADP	74	16
FCOI	83	13	OCP	65	14
CCP	71	18	ISP	57	20
CQS	76	19	PINI	81	19

The assessment of the obtained completeness of each design principle shows that most design aspects are covered by design best practices. In other words, none of the principles is missing a central element.

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