

On the Automatic Detection and Correction of Software Architectural Defects in Object-Oriented Designs

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Outline

- Objective
- Terminology
 - Taxonomy, Classifications, Formalization
- Detection of Software Defects
 - Techniques, Tools
- Correction of Software Defects
 - Techniques, Tools
- Challenges



Objective

- Our Aim
 - “Formalize SAD* including antipatterns and design defects for their detection and correction in object-oriented architectures and to correct them”
- Perspectives
 - Short term: Get some feedback from the WOOR participants
 - Mid term: Formalization of SAD defects and analysis of techniques
 - Long term: Techniques and tools for automatic detection and correction
- Related Work
 - “Anti Patterns: Refactoring Software, Architectures, and Projects in Crisis”, Brown *et al.*



Terminology

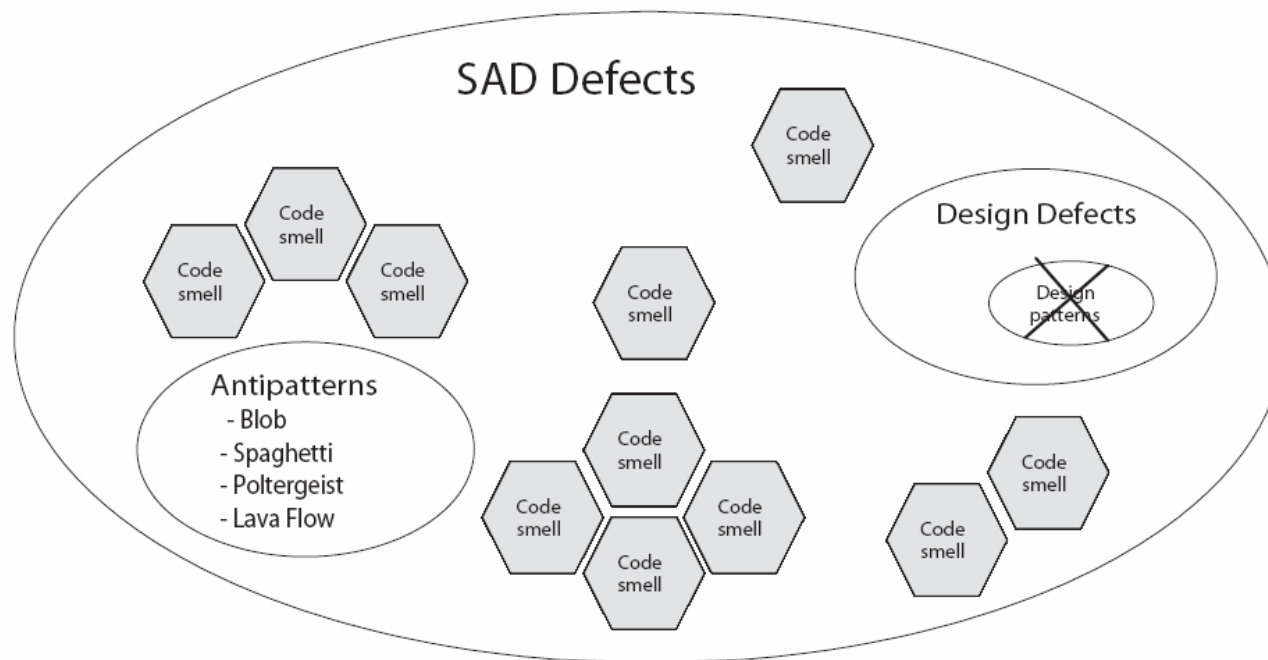
(1/3)

- Taxonomy
 - Antipatterns, design defects, code smells
- Classifications
 - Few classifications of defects at design level
- Among SAD, three categories [1]
 - Intra-classes: Internal structure of a class
 - Inter-classes: External structure of the classes (public interface) and their relationships (inheritance, association...)
 - Behavioural: Semantics of the program

Terminology

(2/3)

■ Classifications





Terminology

(3/3)

■ Formalization

- Only textual descriptions of software defects but no formal description of SAD
 - Ex: Detection of antipatterns by intuition
 - Design defects?
- Meta-models
 - PADL [2], FAMIX [3], DMP [4]
 - Right meta-model to formalise and to detect SAD defects in OO architectures?



Detection of Software Defects

- Existing Techniques
 - Reading techniques (software inspections)
 - At code level: Functional or structural testing
- Suggestions
 - Extraction of code comments
 - Behavioural analysis based on the sequence diagrams
 - Dynamic detection during execution (assertions, pre- and post-conditions)
 - Metrics (number of methods, attributes, LOC)
 - Code smells: Heuristics at the code level for an automatic detection
 - Are they good?
- Tools
 - Ex: OptimalAdvisor, IBM Structural Analysis for Java (SA4J), SmallLint
 - Help in understanding and in visualizing the structure of the code
 - Provide some basic measures (size, inheritance)
 - Highlight some problems
 - **Limited**: Do not support the detection of defects at the design level



Correction of Software Defects

■ Techniques

- Behaviour preserving and non-behaviour preserving refactoring techniques
- Semi-automatic correction

■ Our aim

- To precise, to develop, or to extend refactoring techniques
- Generic techniques applicable on any SAD

■ Tools

- Basic refactorings: package/class/method rename/move/remove, variable insert/remove/rename...



Challenges

■ Future work

- Classifying SAD
- Formalizing SAD
- Defining techniques, tools, and metrics for the automatic detection and the semi-automatic correction of SAD
- Implementing and validating these techniques and tools



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