Investigating the Impact of Active Guidance on Design Inspection

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Abstract. Software inspection helps to improve the quality of software products early in the development process. For design inspection recent research showed that usage-based reading of documents is more effective and efficient than traditional checklists. Usage-based reading guides actively the inspector with pre-sorted use cases, while traditional checklists let the inspector figure out how best to proceed. This paper investigates the impact of active guidance on an inspection process: We introduced checklists that give the inspector a process to follow, which should be as flexible as traditional checklists but more efficient. We compared the performance of this approach in a controlled experiment in an academic environment with traditional checklist and usage-based reading. Main results of the investigation are (a) checklists with active guidance are significantly more efficient than traditional checklists for finding major defects and (b) usage-based reading is more effective and efficient than both types of checklists. These results suggest that active guidance improves the efficiency of inspectors while the upfront investment into usage-based reading pays off during inspection.

Keywords: inspection process improvement, reading techniques, software product improvement, empirical software engineering, active guidance.

1 Introduction

Software inspection is a current approach for quality improvement of software products in industrial environment, since Fagan introduced it in 1976 [5]. Inspection is a defect detection technique to reduce defects in software artifacts and to improve software product quality [4][17]. The inspection method is classified as a static verification and validation technique, which doesn't need executable software. Therefore, inspection approaches are applicable to written text documents, e.g. design documents, as well.

Inspection in our context concentrates on defect detection in early stages of software development, i.e. in design documents. The early elimination of defects leads to a higher level of product quality, due to a lower number of remaining defects and, as a consequence, to a reduction of required resources (e.g. budget, time, etc.). Therefore, inspection is one important approach for software product improvement.

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In order to find defects, inspectors have to traverse the document under inspection. Reading is a key activity in defect detection processes to (1) understand the document under inspection and (2) compare the inspection artifact to a set of expectations regarding content, structure and product quality. This comparison and recognition helps to spot defects. Because of this key activity, several reading techniques (RTs) have been developed to improve inspection process quality.

In general, inspectors have to learn reading and to analyze the software artifacts applying reading techniques. Systematic reading techniques consist of series of steps that help inspectors to understand particular aspects of a document with active reading work and to use this information for defect detection. Important characteristics of RTs are [13]: usability (simplicity to follow predefined guidelines) [16], applicability to different document notation and application domains, repeatability of inspection results, document coverage, and target defects.

Therefore, a well-designed RT must achieve those requirements and uses available knowledge on the structure of a document to provide guidance through the most important parts of the document. RTs support readers while inspecting the document in an active or passive way. Readers using a passive approach inspect the artifact regarding a number of steps sequentially (e.g. given checklist items). Active guidance includes a detailed inspection process (*how to perform an inspection*) and a separation of perception (*what to inspect*) [3][14].

Empirical studies in academic environment use checklists (CBR), scenarios (SBR), use cases (UBR), or perspectives (PBR) [1] [12] to focus on different types of defects, e.g. defect severity classes, document locations, impact of individual defects, etc. to investigate the benefits of the individual RT approaches. Examples for empirical studies are: checklist-based RT (CBR) [15][27] and usage-based RT (UBR) [23][24][25][26][27]. Gilb et al. presents an overview and comparison of CBR and SBR [7]. Families of empirical studies must be performed to provide generalization of empirical findings, e.g. [6][11][18][19][21][29].

Checklist-based reading (CBR) approaches use sequentially predefined items, which lead the inspector through the document under inspection. Inspectors have to traverse the document several times for a complete coverage of the specification document and the checklist. The new checklist-based RT variant (CBR-tc) uses a tailored checklist to provide an active guidance to the inspector. Inspectors have to analyze requirements and system function and prioritize them according to their knowledge of the application domain. This proceeding is included in the inspection process. Usage-based approaches (UBR) use expert prioritized use cases and scenarios for defect detection. Inspectors follow them and traverse the document in order to find defects. The main advantage of UBR is the application of expert prioritized use cases to find the most important defects and the support of active guidance.

This paper presents the results of a large-scale experiment in academic environment at Vienna University of Technology [28]. The empirical study cover a checklist-based reading technique (CBR-gc) using a generic checklist, and a usage-based reading technique approach (UBR) with use cases and a new CBR variant, a tailored checklist (CBR-tc). The aim of this paper is the investigation of the impact of active guidance on the number of defects found at different severity classes (crucial and major defects).