Overview

- Introduction to Software Inspection
  - Detect and remove defects as soon as the software artifacts are created
  - Benefits
    - Software-quality
    - Budget and time
    - Effect: 50%-90% [Gilb93]
  - Context
  - Design reviews
- Dimensions
  - Technical
  - Economic
  - Organizational
  - Tool

A Generic Software Development Model

The Technical Dimension of Software Inspection

The Original Approach

Fagan 1976

Five Phases:
- Overview
  - Author briefs the inspection team
- Preparation
  - Inspectors go through the document
- Inspection
  - A meeting to find defects, "synergy" effect
  - Reader, inspector, moderator, from start to finish
- Rework
  - Author addresses the defects found
- Correction or justification
- Follow-up
  - Moderator checks if re-inspection needed

Why Inefficient

Weiss and Parnas 1985

Problems with the Original Approach
- Difficult to find relevant information in the mass of documentation
- Unfamiliar with all the goals and constraints
- No concentrated examination
- Passive initiation, no explicit responsibility
- Limited interaction
- Wrong people selected
- Beyond competence
- Non-systematic
Active Design Reviews

- Making Design Reviewable
  - Desirable properties
  - Well structured, simple, efficient, adequate, flexible, practical, implementable, standardised
  - Making assumption explicit
  - Including redundant information
  - Organising document
  - Common information, cross-references, indices

- Identifying Review Types
  - Assumption validity, assumption sufficiency, consistency between assumptions and functions, function adequacy, etc.

- Classifying Reviewers (Inspectors)
  - Specialist, potential users, experienced designers, enthusiastic logical inconsistency detectors, etc.

Active Design Reviews (cont.)

- Designing The Questionnaires
  - Make the reviewers take an active stand
  - “Is there an assumption that justifies the implementation of the function?”
  - “Which assumptions tell you…?”

- Conducting The Review
  - Designer: present brief overview
  - Reviewer: ask question
  - Reviewer: review document sections, complete questionnaires
  - Designer: read the completed questionnaires
  - One-on-one or small group meeting
  - Discuss reviewer’s answer, reviewers defend their answers
  - Designer: produce new version of documentation, including the issues raised during the review

Impact

- Effects
  - Help select appropriate reviewers
  - Make good use of reviewer’s skill
  - Make effective use of reviewer’s time
  - Every reviewer contributes
  - Rapid focus on specific problems

- Results
  - More errors found

- Impacts on Research
  - Documentation
  - Role and responsibility
  - Reading techniques
  - Meeting
Related 1: Asynchronous Software Inspection

Problems of Conventional Meeting
- Cost, scheduling
- Effect, “synergy”?
- Gain and loss, meeting sensitivity, data variance
- Personal relationship

Asynchronous Inspection Model
- Email communication
  - Procedure: Individual detection → circulate defect list to others → Why I did not find the error → second round inspection → send final list to moderator → implicit voting and decision
  - Roles and responsibilities
    - Moderator: planning, monitoring communication, compiling final defect list
    - Author: answering questions from inspections
    - Inspector: looking for defects


Related 1 (cont.)

Tool Support
- Threads of discussion, sharing of information, train of thought, visual cues, reaching consensus, coordination

Effects
- No meeting cost
- Anytime, anywhere inspection
- Explicit contribution, inspection record
- Parallel conversation
- Automation
- Anonymity, etc.

How It Extends Parnas’ Idea?
- Common goals: reduce meeting cost, increase meeting efficiency
- Active review: one-on-one or small group meeting, specific discussion
- Asynchronous inspection: no meeting, specific discussion and parallel conversation


Reading Techniques

Motivation
- Inspection results depend on inspectors and their strategies
  - Good strategies make detection less dependent on human factors

Strategies
- Ad hoc
- Checklist-based
- Reading by Stepwise Abstraction
- Questionnaire-based (Active Design Reviews)
- Scenario-based
- Defect-based
- Function-based
- Perspective-based

Related 2: Detection Methods

Comparison of Detection Methods
- Non-systematic techniques:
  - Ad-hoc: little reading support, detection fully depends on inspectors.
  - Checklist-based: a list of questions
  - Ad-hoc/Checklist: search for a wide variety of faults
- Systematic techniques:
  - Scenario-based: search for different, specific classes of faults
  - Different scenarios: focus on different defect types, broad coverage
  - Efficiency depends on content and design of scenarios
  - Different classes: focus on different defect classes
  - Function Point Scenarios: focus on function point items
  - Perspective-based: depends on roles


Related 2 (cont.)
Systematic Inspection Hypothesis

Related 2 (cont.)
Detection Methods Relationship

<table>
<thead>
<tr>
<th>Detection Method</th>
<th>Checklist</th>
<th>Scenario</th>
</tr>
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<tbody>
<tr>
<td>Optimistic</td>
<td>Optimistic</td>
<td>Optimistic</td>
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<tr>
<td>NFR</td>
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<tr>
<td>BS</td>
<td>Checklist</td>
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<tr>
<td>Ad Hoc</td>
<td>Scenario</td>
<td>Scenario</td>
</tr>
</tbody>
</table>
Related 2 (cont.)

Experiments

- Design
  - Multi-trial experiment
  - 48 CS graduate students → 16, 3-person teams
  - Two SRS each team
  - Combination of Ad hoc, Checklist or Scenario methods.

- Metrics
  - Individual fault detection rate
  - Team fault detection rate
  - Percentage of faults first identified at the collection meeting
  - Percentage of faults first identified by an individual, but never reported at the collection meeting

Related 2 (cont.)

Conclusion

- Conclusions
  - Higher fault detection rate (43/41/57, 31/24/45)
  - More effective detecting specific faults
  - Checklist no more effective than Ad hoc
  - Meetings have no net improvement

- How It Extends Parnas’ Idea?
  - Common approach: assigning inspectors to specific defect types
  - Scenario-based method more general
  - Coverage vs. Effective usage
  - Empirical results

Related 3: Perspective-Based Reading

- Inspected From Different Roles
- One Or Multiple Scenarios For Each Perspective
- Broad Coverage
- Experiment
  - Variables
    - Reading Technique: defect-based (MF, ID), perspective-based
    - Perspective: tester, designer, user
    - Documents: generic (A/NM), specific (Flight dynamics)
  - Metrics: team/individual defect detection rate
  - Goal: find relationship between variables
  - Training → detection
  - Analysis approach: statistical method
Related 3 (cont.)

Conclusion

- Conclusions
  - Better coverage (.51/3.3, .62/4.8, .85/7.9)
  - Independent on experience
  - Slightly higher individual detection rate (.51/4.7)
- How It Extends Parnas’ Idea?
  - Common approach: select appropriate inspectors
  - Coverage vs. Effective usage
  - Empirical results

Uncited:

Inspection Discipline and Flexibility

- Motivation
  - Exploring the relationship between discipline and flexibility
  - Designing tailorabe and effective inspection method for defect detection
- Discipline
  - Prescriptive metrics: roles, procedures; goals, quality model; inspection maturity; grade of competence
- Flexibility
  - Place and time independence; tailorability to process, varying number of participants
  - New types:
    - Virtual logging meeting
    - No logging meeting
    - Pair inspection
    - Limited logging meeting

Uncited (cont.)

Discipline/Flexibility Dimensions

It Extends Parnas’ Idea

- Pair inspection and limited logging meeting → one-on-one or small group meeting