Reducing Errors & Improving Quality Through Reviews

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### Report Documentation Page

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<td>Stephen F. Austin State University, Department of Computer Science, Nacogdoches, TX, 75962</td>
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Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18
Please note…

- Stephen F. Austin State University is NOT in Austin – it is in Texas’ oldest city, Nacogdoches – in the northeast corner of the state.
Enough reviews for you????

- Review
- Management Review
- Technical Review
- Inspection
- Peer Review
- Walk-Through
- Audit
- “Skim” Review
- Disciplined Document Review
- Desk Check
- Personal Document Review
- Personal Code Review

- Code Review
- Design Review
- Formal Qualification Review
- Requirements Review
- Test Readiness Review
- Functional Configuration Audit
- Physical Configuration Audit
- Etc.
What reviews give you

◆ Direct Benefits
  – Improved code quality
  – Fewer Defects
  – Improved communication about code content
  – Education of new/junior developers

◆ Indirect benefits
  – Shorter and more effective testing
  – Less maintenance
  – Improved customer satisfaction
  – More maintainable code
Quality is the goal

- Quality is NOT free
- “Cost” of Quality includes
  - Review costs
  - Tests cost
  - All defect prevention costs (training)
- Savings from Quality include
  - Decreased costs of product failure
    - Help Desk
    - Customer defect repair
  - Shorter test cost
  - Shorter development time
Return on Investment

- Boeing – 33:1 savings from reviews
- HP – 10:1 saving $21 million a year
- Space Shuttle – $1 if error found in inspection, $13 during test, $92 after delivery
- IBM – each hour of inspection saved 20 hours of testing, and 82 hours of rework (for each error that would have made it to delivery)
- AT&T – 22:1 savings if errors found early, reduced cost of finding errors by 10:1
More savings

- Maintenance costs are typically 50% less (values of 90% have been reported)

- Litton Data Systems – 3% increase in costs due to inspections, number of errors found during system and integration testing dropped 30%
Reviews vs. Testing

- Testing is a discrete activity, reviews should be continuous.
- Each testing stage only removes about 35% of errors present.
- GOOD Reviews and Inspections typically remove 50%.
- Testing can give poor code coverage, and will always give poor coverage of documentation.
What can be reviewed?

◆ ?? (fill in the blanks)
What can be reviewed?

- ?? (fill in the blanks)

What can’t be reviewed?
Management Involvement is limited

- Measurement dysfunction – when managers use review data to evaluate. This produces inconsistent results and bizarre behavior.

- Leads to inaccurate data, invalid reviews, and the use of reviews to grind “personal” issues.

- Management involvement should be limited to “edited” and “sanitized” summarization of the final results.
Management Commitment

- Provide resources (time and space)
- Setting policies and goals
- Maintaining reviews even when under a time crunch
- Require schedules to include review time
- Providing training
- Not using results to evaluate
- Holding people accountable for participation and contributions
Management Commitment (cont.)

- Rewarding early adopters
- Running interference with challengers
- Respecting review team’s appraisal
- Asking for status reports, showing how the program is working, what it costs, and the benefits (and deficits)
Consequences of Misapplication of Inspection Data

- Developers might not submit products
- Developers might not agree to review peer’s work
- Defects brought up after the review, not during
- Pre-reviews to prepare
- Too much debate on what is a defect
- Review of small products – wasting time
Ego-less programming

- Need to stress the benefits of reviews to all levels of management
  - Less time in rework
  - Increased productivity
  - Education and learning
  - Better able to meet deadlines
  - Better risk management

- Not “extra time”, but reallocation of effort
Reviews are NOT milestones

- Milestones are a “time”
- Reviews are a “process”

- Milestones occur AFTER a review, and involve a go/no-go decision
Principles for a review

1. Check egos at the door
2. Keep the review team small
3. Find problems, don’t solve them
4. Limit review time
5. Require preparation
Peer Review Spectrum

- Inspection
- Team Review
- Walkthrough
- Pair Programming
- Peer Deskcheck
- Ad Hoc

Most formal

Least formal
## Typical Activities

<table>
<thead>
<tr>
<th>REVIEW TYPE</th>
<th>Planning</th>
<th>Preparation</th>
<th>Meeting</th>
<th>Corrections</th>
<th>Verification</th>
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<td>Inspection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Team Review</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Walkthrough</td>
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<td>Pair Programming</td>
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<td>Ad Hoc</td>
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<td>No</td>
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<td>Individual</td>
<td>No</td>
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</table>

Reviews Cook 2010
Which type of review for you?

- Depends upon
  - Criticality of application
  - Skill of individual reviewer
  - Needs of the organization
  - Maturity of the organization
<table>
<thead>
<tr>
<th><strong>Review Objective</strong></th>
<th><strong>Inspection</strong></th>
<th><strong>Team Review</strong></th>
<th><strong>Walkthrough</strong></th>
<th><strong>Pair Programming</strong></th>
<th><strong>Peer Deskcheck</strong></th>
<th><strong>Passaround</strong></th>
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<tr>
<td>Find defects</td>
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<td>X</td>
<td>X</td>
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<td>Conformance to specs</td>
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<td>Verify complete and correct</td>
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<td>X</td>
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<td>Assess understandability and maintainability</td>
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<td>X</td>
<td>X</td>
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<td>Demonstrate quality</td>
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<td>Collect data for improvement</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Review Objective</td>
<td>Inspection</td>
<td>Team Review</td>
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<td>Pair Programming</td>
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<tr>
<td>Measure quality</td>
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<td>Education of team members</td>
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<td>X</td>
<td>X</td>
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<td>Reach consensus on approach</td>
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<td>X</td>
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<td>Ensure changes of fixes made correctly</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Explore alternative approaches</td>
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<tr>
<td>Simulate execution of a program</td>
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<tr>
<td>Minimize review cost</td>
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<td></td>
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Common Misconception

- Peer reviews are a luxury

- TRUTH: Peer reviews, when intelligently applied, shorten development and testing. In fact, some testing steps may be skipped (or will be so small they are almost a formality)
How fast to review

- Studies show that 200 LOC/hour is close to optimal
  - More, and you miss errors
  - Less, and you get diminishing returns

- With 200 LOC/hour, defects will be reduced to around 20 per 1000 LOC
Rules for reviews

- Schedule no less than a week in advance, to give participants time to prepare
- No more than one inspection per day for any one participant (including the moderator)
- No “lunch” inspections
- No “3 PM Friday” inspections
- Coffee and donuts are a necessity
- Have a time limit – and STICK TO IT!! End when the time is up
Before the review – perform “Skim Review”

◆ Brief one-time reading (similar to reading a novel)
◆ Guidelines for “skim review”
  – Don’t depend on ad-hoc, skim reviews to find all (or even most of) the defects
  – Use them to overview document
  – Use them to check that entrance criteria for review have been met (e.g., not more than 3 major defects found in 10 minutes)
During any structured review

- Have recorder!!!
- Have a recorder who knows how to record!!!
- Use semi-formal & formal documents to record errors (location, side effects, any other specifics)
- Use the same documentation to provide accountability and reduce need for follow-up (although spot-checking of follow-up is HIGHLY recommended)
Seven “Truths” about Reviews *

- Peer reviews can take many forms
- Inspections are a software industry best practice
- There is no one true inspection method
- Peer reviews complement testing
- Peer reviews are both technical and social activities
- Managers can make or break a review program
- A peer review program doesn’t run itself

* This slide and the next from Karl Wiegers’ Book
   Reviews  Cook 2010
## Comparison of methods

<table>
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<th>Fagan Method</th>
<th>Gilb/Graham Method</th>
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<td>• Planning</td>
<td>• Planning</td>
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<tr>
<td></td>
<td>• Overview</td>
<td>• Kickoff Meeting</td>
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<td></td>
<td>• Preparation</td>
<td>• Individual Checking</td>
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<td></td>
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<td>• Logging Meeting</td>
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<td></td>
<td>• Rework</td>
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<td>• Follow-up</td>
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<td>• Causal Analysis</td>
<td>• Process Brainstorming Meeting</td>
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<td></td>
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<td>• Inspection Leader</td>
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<td></td>
<td>• Reader</td>
<td>• Scribe</td>
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<td>• Checker</td>
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<td>• Inspector</td>
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<td>• Rule Sets</td>
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<td>• Document Quality</td>
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<td>• Measurement</td>
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<tr>
<td></td>
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<td>• Process Improvement</td>
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Remember - to make reviews work...

- No discipline or rigor is normally associated with informal reviews, so effective leaders and checklists must be used to achieve useful results
- To make reviews useful, members of the review team must be objective
  - Make sure that some members of the review team have different backgrounds
  - Make sure that some members of the review team have no direct involvement with the product being reviewed
  - Political agendas need to be left at the door
- Make sure that reviewers understand the requirements
  - If necessary, present requirements in a number of different ways
  - Simply reading the requirements documents is probably insufficient
  - The brain can only keep so many requirements “active”
Questions???
References

- *Peer Reviews*, a STSC Workshop presented at Orlando Naval Air Warfare Center, Training Systems Division, (May 2008) by Dr. David A. Cook
- *Managing the Software Process* by Watts Humphrey (Addison-Wesley, 1989)