

Collaborative Code Construction: Code Reviews and Pair Programming

CPSC 315 – Programming Studio

adapted from John Keyser's 315 slides

Collaborative Construction

- Working on code development in close cooperation with others
- Idea
 - Developers don't notice their own errors very easily
 - Others won't have the same blind spots
 - Thus, errors are caught more easily by other people
- Takes place during the *construction* process

Benefits of Collaborative Construction

- Can be much more effective at finding errors than testing alone
 - 35% errors found through testing through low-volume Beta level
 - 55-60% errors found by design/code inspection
- Finds errors earlier in the process
 - Reduces time and cost of fixing them
- Provides mentoring opportunity
 - Junior programmers learn from more senior programmers

More Benefits

- Creates collaborative ownership
 - No single “owner” of code
 - People can leave team more easily, since others have seen code
 - Wider pool of people to draw from when fixing later errors in code

Some Types of Collaborative Construction

- Formal inspections
- Walkthroughs
- Code reading
- Pair programming

Code Reviews

- Method shown to be extremely effective in finding errors
 - ratio of time spent in review vs. later testing and error correction ranges from 1:20 to 1:100
 - Reduced defect correction from 40% of budget to 20%
 - Maintenance costs of inspected code is 10% of non-inspected code
 - Changes done with review: 95% correct vs. 20% without
 - Reviews cut errors by anywhere from 20% to 80%
 - Several others (examples from *Code Complete*)

Reviews vs. Testing

- Finds different types of problems than testing
 - Unclear error messages
 - Bad commenting
 - Hard-coded variable names
 - Repeated code patterns
- Only high-volume beta testing (and prototyping) find more errors than formal inspections
- Inspections typically take 10-15% of budget, but usually reduce overall project cost

Formal Inspection Characteristics

- Focus on *detection*, not correction
- Reviewers prepare ahead of time and arrive with a list of what they've discovered
 - Don't meet unless everyone is prepared
- Distinct roles assigned to participants
 - Stick to these roles during review
- Data is collected and fed into future reviews
 - Checklists focus reviewers' attention on common past problems

Roles during Inspection

- Moderator
- Author
- Reviewer(s)
- Scribe
- Management

- 3 people min
- ~6 people max

Roles during Inspection

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- Keeps review moving
 - Not too fast or slow
 - Technically competent
 - Handles all meeting details
 - distributing design/code
 - distributing checklist
 - Setting up room
 - Report and followup

Roles during Inspection

- Moderator
 - Author
 - Reviewer(s)
 - Scribe
 - Management

 - 3 people min
 - ~6 people max
- Plays minor role
 - Design/Code should speak for itself
 - Should explain parts that aren't clear
 - But this alone can be a problem
 - Explain why things that seem to be errors aren't
 - Might present overview

Roles during Inspection

- Moderator
 - Author
 - Reviewer(s)
 - Scribe
 - Management

 - 3 people min
 - ~6 people max
- Interest in code but not an author
 - Find errors during preparation
 - Find more errors during meeting

Roles during Inspection

- Moderator
 - Author
 - Reviewer(s)
 - Scribe
 - Management
- Records errors found and action assigned or planned
 - Should not be moderator or author
- 3 people min
 - ~6 people max

Roles during Inspection

- Moderator
 - Author
 - Reviewer(s)
 - Scribe
 - Management
- Usually should not be involved
 - Changes from technical to political meeting
 - Might need to see results of meeting
- 3 people min
 - ~6 people max

Stages of Inspection – Planning

- Author gives code/design to moderator
- Moderator then:
 - chooses reviewers
 - ensures code is appropriate for review
 - e.g. line numbers printed
 - distributes code and checklist
 - sets meeting time

Stages of Inspection – Overview

- If reviewers aren't familiar with code at all, can have overview
- Author gives a brief description of technical requirements for code
- Separate from review meeting
- Can have negative consequences
 - Groupthink
 - Minimize points that should be more important

Stages of Inspection – Preparation

- Reviewers work alone to scrutinize for errors
 - Checklist can guide examination
- Depending on code, review rate varies
 - 125 to 500 lines per hour
- Reviewers can have varied “roles”
 - be assigned “perspective”
 - e.g. evaluate from user’s view, or from designer’s view
 - evaluate different scenarios
 - e.g. describe what code does, or whether requirement is met
 - read code/design in certain order/way
 - e.g. top-down, or bottom-up

Stages of Inspection – Inspection Meeting

- A reviewer chosen to paraphrase design or read code
 - Explain all logic choices in program
- Moderator keeps things moving/focused
- Scribe records errors when found
 - Record type and severity
- Don’t discuss solutions!
 - Only focus is on *identifying* problems
 - Sometimes don’t even discuss if it actually is an error – if it seems like one, it is one
- No more than 1 per day, about a 2 hour limit

Stages of Inspection – “Third Hour” meeting

- Depending on interest/stake of reviewers, possibly hold a *separate* followup meeting
 - Immediately after inspection meeting
- Focus here is to discuss possible solutions

Stages of Inspection – Inspection Report

- Moderator produces report shortly after meeting
 - List of defects, types, and severity
- Use this report to update checklist to be used in future inspections
 - List main types of errors commonly found
 - No more than 1 page total length
- Collect data on time spent and number of errors
 - Helps evaluate how well things work, justify effort

Stages of Inspection – Rework

- Moderator assigns defects to someone to repair
 - Usually the author

Stages of Inspection – Follow-Up

- Moderator verifies that work assigned was carried out.
- Depending on number and severity of errors, could take different forms:
 - Just check with author that they were fixed
 - Have reviewers check over the fixes
 - Start cycle over again

Adjusting Inspections Over Time

- Organizations will have characteristics of code unique to them
 - Density of code determines how fast reviewers and inspection meeting can go (application tends to be faster than system code/design)
 - Checklists highlight common problems
- Measure effect of any changes
 - Evaluate whether they actually improved process

Inspections and Human Egos

- Point is to improve code
 - Not debate alternative implementations
 - Not discuss who is wrong/right
 - Moderator needs to control discussion
- Author needs to be able to take criticism of code
 - May have things mentioned that aren't "really" errors
 - Don't debate and defend work during review
- Reviewers need to realize the code is not "theirs"
 - Up to author (or someone else) to determine fix

Walkthroughs

- Alternative to formal code inspection
- Vague term, many interpretations
 - Less formal than inspections, though
- Usually hosted and moderated by author
- Chance for senior and junior programmers to mix
- Like inspection:
 - Preparation required
 - Focus on technical issues
 - Goal is detection, not correction
 - No management

Walkthrough Evaluation

- In best cases, can match formal code inspections in quality
- In worst cases, can lower productivity, eating more time than saved
- Can work well for large groups
- Can work well when bringing in “outsiders”

Code Reading

- Alternative to inspections and walkthroughs
- Author gives out code to two or more reviewers
- They read independently
- Meeting held for everyone
 - Reviewers present what they've found, but don't do a code walkthrough

Code Reading Evaluation

- Most errors tend to be found in individual review
 - Reduces effort and overhead of managing group dynamics at inspection meeting
 - Maximizes productive effort per person – time not wasted in meetings where others are speaking
- Works well for geographically distributed reviewers

Pair Programming

- Basic idea: One person codes with another looking over the shoulder.
- Person at keyboard writes code
- Second person is *active* participant
 - Watch for errors
 - Think strategically about code
 - What's next?
 - Is code meeting overall goal/design?
 - How to test this code

Successful Pair Programming

- Standardize coding style
- Don't force pairs for easy tasks
- Rotate pairs and work assignments frequently
- Use "good" matches
 - Avoid personality conflicts
 - Avoid *major* differences in speed/experience
- Set up good work environment
- At least one pair member should be experienced

Evaluating Pair Programming

- Seems to achieve quality level similar to formal inspection
- Tends to decrease development time
 - Code written faster, fewer errors
- Tends to be higher quality code
 - Holds up better during crunch time – fewer shortcuts taken that come back to haunt
- All the traditional collaborative benefits