Hasso Plattner Institut
IT Systems Engineering | Universität Potsdam

Software Reviews

Christoph Matthies
christoph.matthies@hpi.de

Software Engineering II
WS 2018/19

Enterprise Platform and Integration Concepts

Review Definition

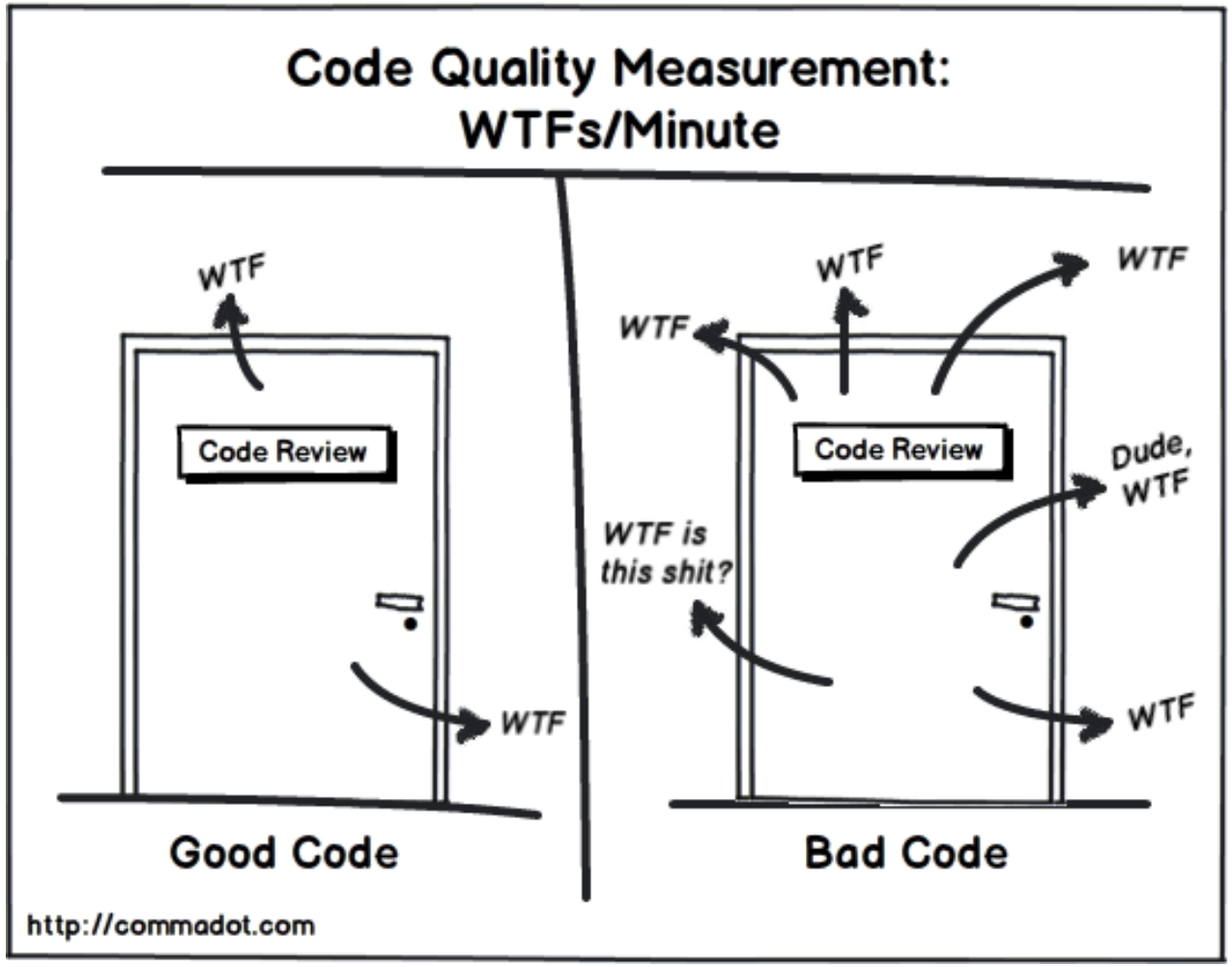
"[Formal or informal] meeting during which a **software product** is [**examined** by] project personnel, managers, users, customers, user representatives, or other interested parties **for comment or approval**" - IEEE1028

- Generate comments on software
- Several sets of eyes check
- People instead of using tools

Reviews Motivation

[Bacchelli ‘13]

- Improve code
- Discuss alternative solutions
- Transfer knowledge
- Find defects



Involved Roles

[Giese]

Manager

- Assessment is an important task for manager
- But: Lack of technical understanding
- But: Assessment of a product vs. assessment of a person
- Outsider in review process, but should support with resources (time, staff, rooms, …)

Developer

- Should not justify but only explain their results
- **No boss** should take part at review

Review Team

[Giese]

Team leader

- Responsible for quality of review
- Technical, personal and administrative competence
- Moderation of review meetings

Reviewer

- Study the material before first meeting
- Don’t try to achieve personal targets!
- Gives positive *and* negative comments on review artifacts
  - Not on the author!

Recorder

- Any reviewer, can rotate even in review meeting
- Protocol as basis for final review document

Task of Review Team

[Giese]

Deliver a good review

- “Don’t shoot the messenger”
- Find problems, but don’t try to solve them

Artifact of interest should be assessed

- Accepted, partly accepted, needs corrections, rejected
- Acceptance only possible if no participant speaks against it

Problems should be clearly identified / extracted

Types of Reviews [IEEE1028-97]

Management Review

- Monitor progress and status of plans, confirm requirements
- **Evaluate effectiveness** of management approaches / corrective actions

Technical Review

- Evaluate entire software on suitability for intended use
- Provide evidence whether software product **meets specifications**

Types of Reviews [IEEE1028-97]

Inspections

- Identify software product anomalies, invented at IBM in the 1970's
- **Formal process**, can involve hard copies of the code and documents
- Review team members check important artifacts independently, consolidation meeting with developers
- Preparation time for team members, shorter meetings

Walk-through

- Evaluate software, focus on **educating an audience**
- Organized by developer for reviewing own work
- Bigger audience can participate, little preparation for team members

What to Review?

[Galin2004]

Should be reviewed	Might not have to be reviewed
Parts with complicated algorithms	Trivial parts where no complications are expected
Critical parts where faults lead to system failure	Parts which won't break the functionality if faults occur
Parts using new technologies / environment / …	Parts which are similar to those previously reviewed
Parts constructed by inexperienced team members	Reused or redundant parts

Comparison of Review Types

[Giese, 2012]

Eigenschaft	Formaler technischer Review	Inspektion	Walkthrough	Persönlicher Review
Vortreffen	**Nein**	**Ja**	**Nein**	**Nein**
Vorbereitung der Teammitglieder	**Ja – sehr gründlich**	**Ja - gründlich**	**Ja - oberflächlich**	**Nein**
Sitzung	**Ja**	**Ja**	**Ja**	**Nein**
Nachfolgende Aktivitäten	**Ja**	**Ja**	**Nein**	**Nein**
Formales Training der Teilnehmer	**Nein**	**Ja**	**Nein**	**Nein**
Checklisten	**Nein**	**Ja**	**Nein**	**Nein**
Systematische Erfassung von Fehlern	Nicht formal benötigt	Formal benötigt	Nicht formal benötigt	Nicht formal benötigt
Reviewdokument	Formal design review report	**1**) Bericht zu den Ergebnissen der Sitzung 2) Zusammenfassung der Sitzung		

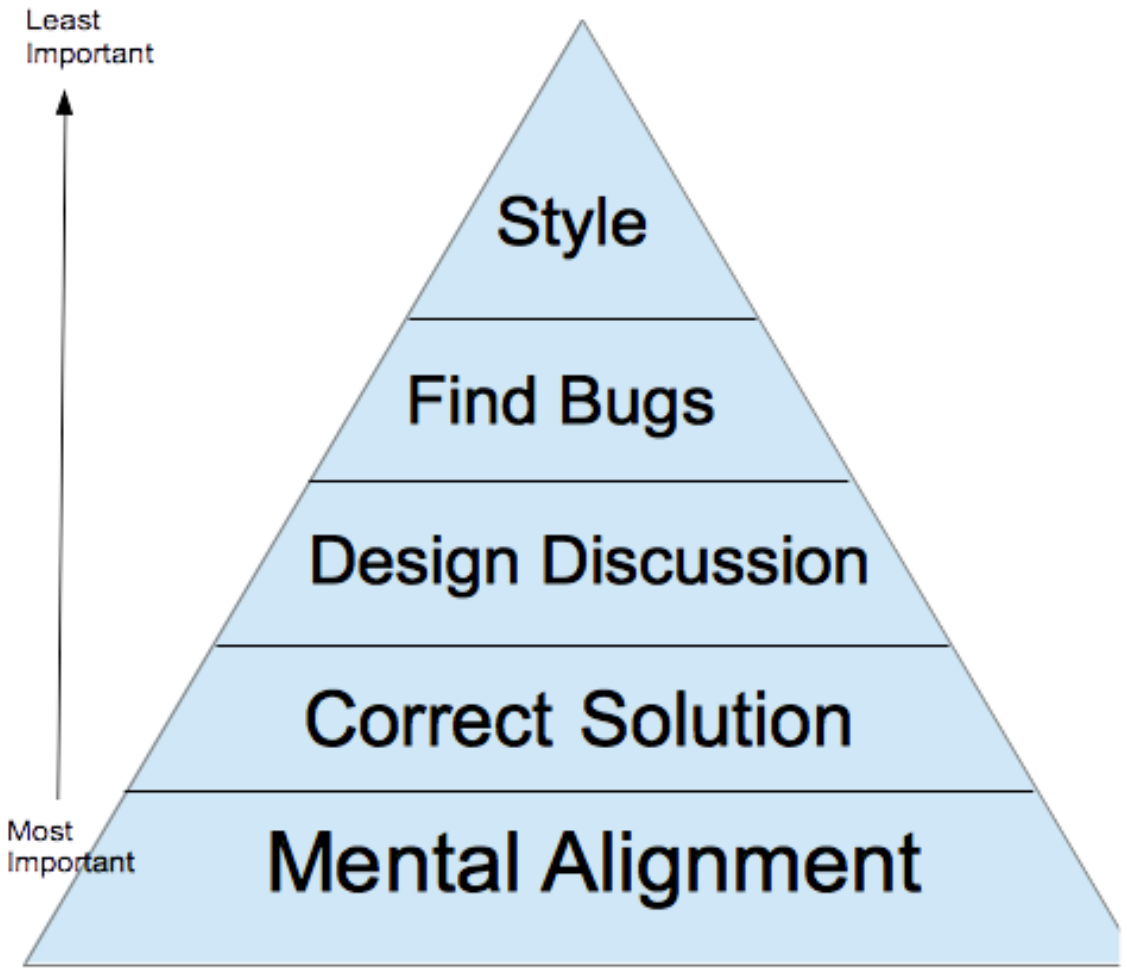
Modern Code Reviews

[Rigby'13]
[Bacchelli'13]

- Follows more **lightweight**, **flexible** process
- Change sizes are **smaller**
- Performed **regularly** and **quickly**,
  mainly just before code committed to main branch

- Shift from defect finding to group problem solving activity
- Prefer discussion and fixing code over reporting defects

Code Review Hierarchy of Needs



Hierarchy

- Findings bugs vs. understanding code
- Building a shared mental model
- Ensuring sane design

http://blakesmith.me/2015/02/09/code-review-essentials-for-software-teams.html

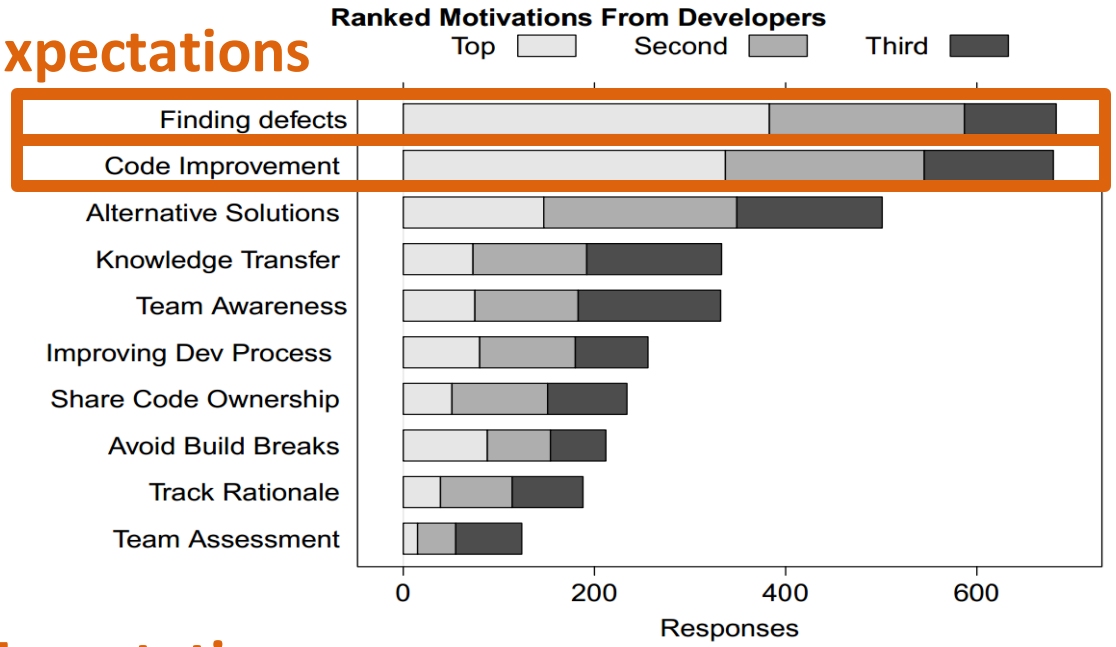
Recent Research

[Bosu'17]
[McIntosh'14]
[Bacchelli '13]

- Code review coverage and review participation share significant link with **software quality**
- Most comments concern code improvements, understandability, social communication
- Only ~15% of comments indicate possible defect
- Developers spend approximately five hours per week (10-15% of their time) in code reviews

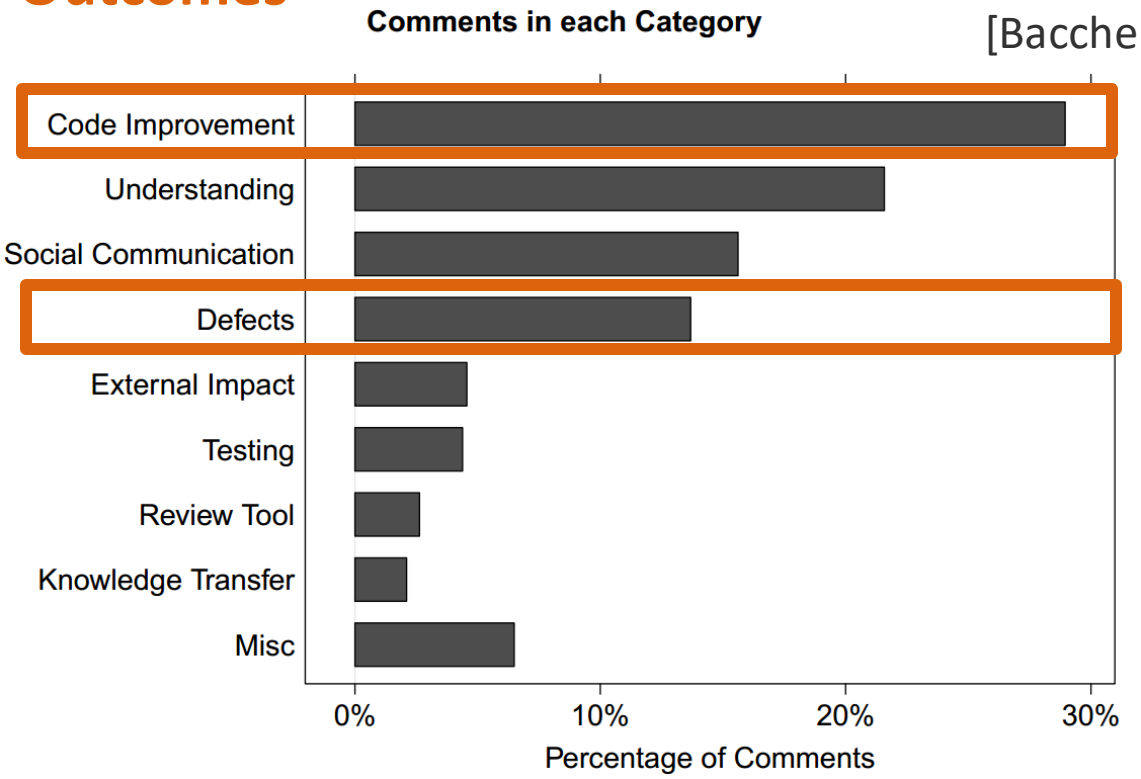
Recent Research

Expectations



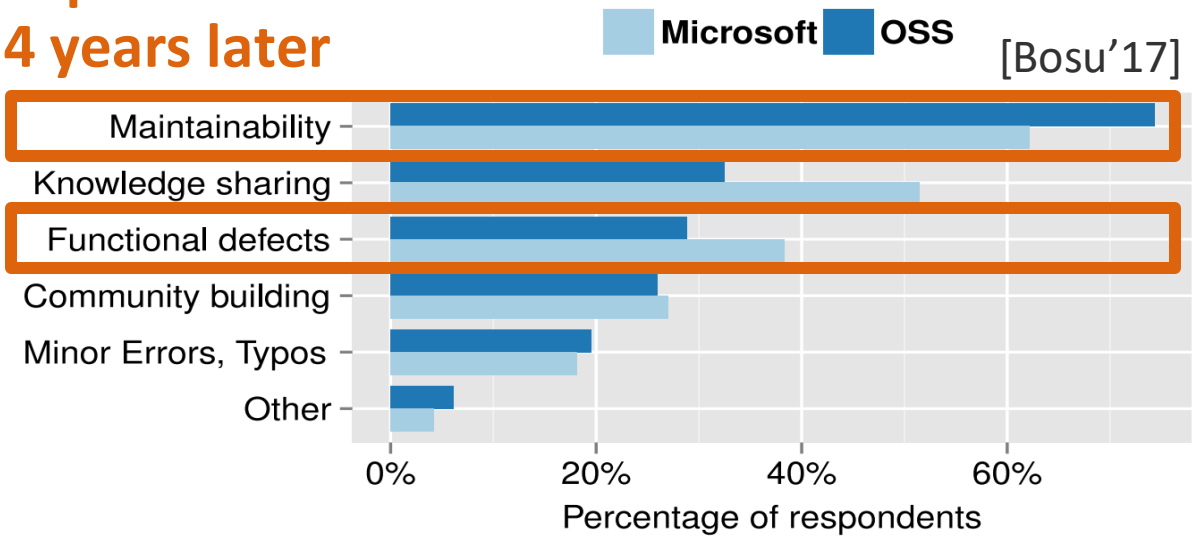
Outcomes

[Bacchelli '13]



Expectations 4 years later

[Bosu'17]



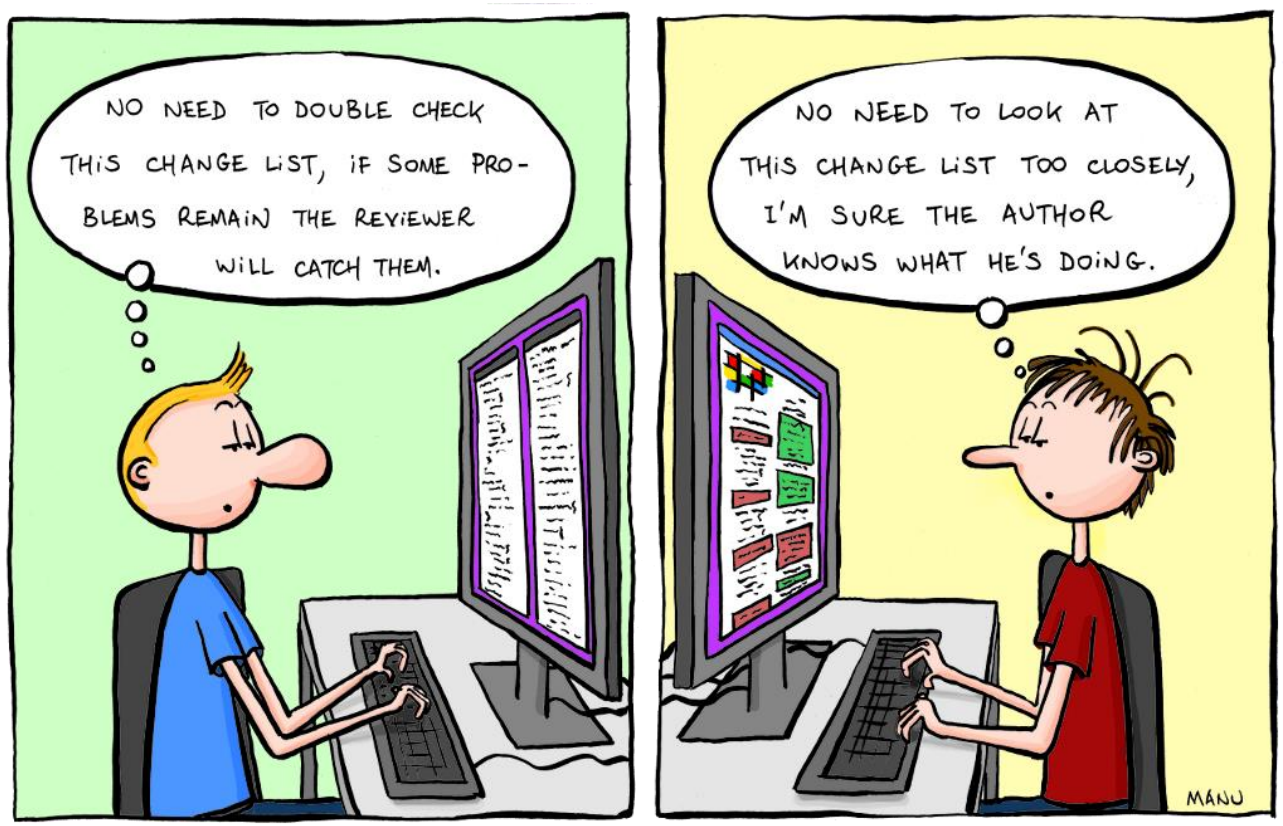
Maintainability and code improvements identified as most important aspects of modern code reviews

Challenges of the Review Process

- **Delay** the use of implemented features
- Forces the reviewers to **switch context** away from their current work
- Offer little feedback for **legacy code**

- **Overloading** (too many files), developers create large patches

- **Overcrowding** (too many reviewers), assigning too many reviewers may lower review quality



Post-commit Code Review

- Review after committing to VCS (pull requests are one! way of doing this)
- Used by most projects on GitHub and BitBucket

+

- Developers can commit continuously
- Other team members see code changes in VCS and can adapt their work
- Flexible definition of the code to be reviewed (set of commits, whole branch, some files)

–

- Chance of unreviewed code in main repository
  - Need to / can set restrictions
- Requires branches or similar to work effectively
- May take a while for developers to come back to the code and improvement ideas

https://www.devart.com/review-assistant/learnmore/pre-commit-vs-post-commit.html

Pre-commit Code Review

- Review before committing to version control system (e.g. using mailing lists / Gerrit, Crucible tools)
- Used by e.g. Linux Kernel, Git, Google

+

- No code enters unreviewed
- Code quality standards met before commit, no 'fixes'
- No repository access needed for reviews
- Other developers definitely not affected by bugs in reviewed code

–

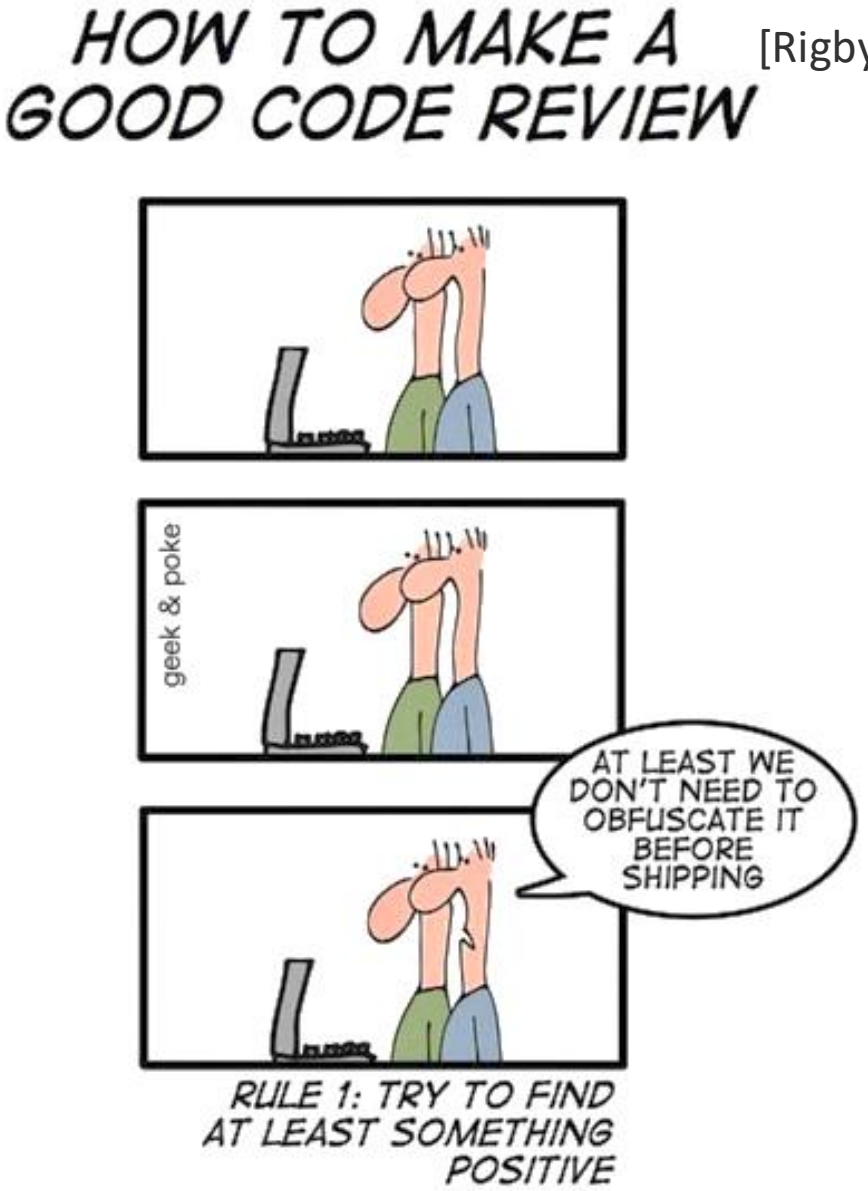
- Reviewing all code takes time
  - Deciding what needs a review takes time too
- Possibly another complex system to handle
  - Might not want to work on submitted code until review done (e.g. mailing list)

Reviewer Assignment

- Usually, **two reviewers** find an optimal number of defects.

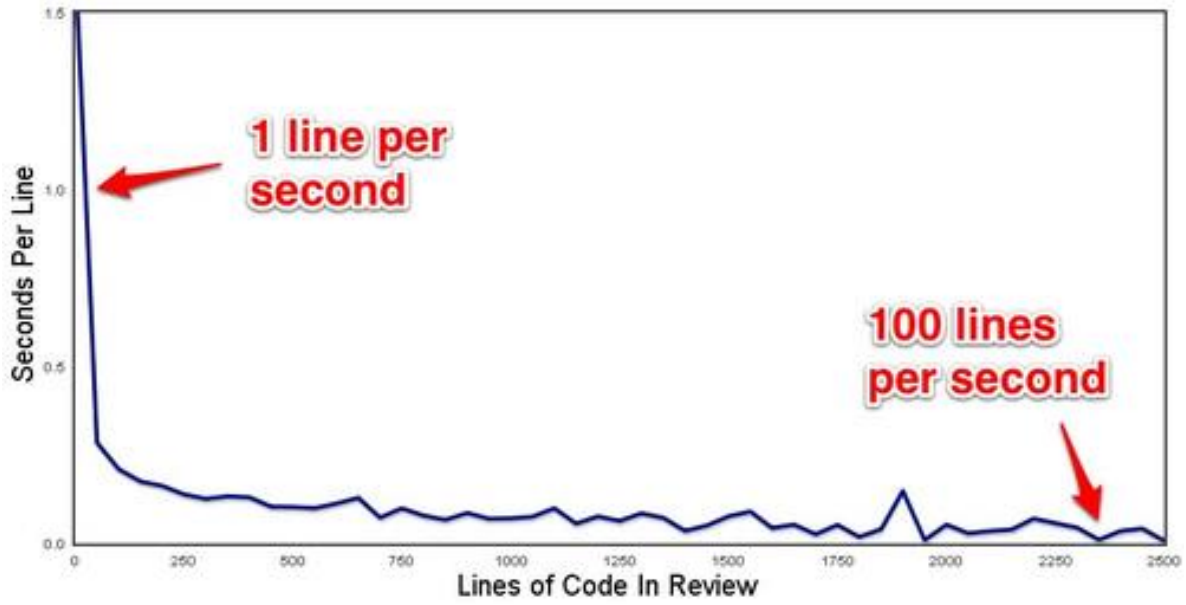
- People who contributed changes (find defects)
- New developers (transfer knowledge)
- Team members with a small review queue
- Reviewers with different fields of expertise
- Let reviewers know what they should look out for

[Rigby'13]



Maximize Usefulness

- "Ask a programmer to review 10 lines of code, he'll find 10 issues. Ask him to do 500 lines and he'll say it looks good." - Giray Özil



- Semantically coherent set of changes easier to review than interleaved concerns

http://atlassianblog.wpengine.com/developer/assets_c/2011/07/mt-perloc-thumb-500x263-7290.png

Code Review In Industry

[Rigby'13]

Microsoft

- Median completion times: 14.7h (Bing), 18.9h (Office), 19.8h (SQL Server)
- Median number of reviewers: 3-4
- Developers spend 4-6 hours per week on reviews

Google

- Mandatory review of every change
- Median completion times: 15.7h (Chrome), 20.8h (Android)
- Median patch size: 78 lines (Chrome), 44 lines (Android)
- Median number of reviewers: 2

Code Review Tools

Gerrit (https://code.google.com/p/gerrit/)

- Integrated with Github: http://gerrithub.io
- Used by, e.g., Chromium, Eclipse, Qt, Typo3, Wikimedia, etc.
- Plug-ins available (e.g. EGerrit for Eclipse)

Review Ninja (http://review.ninja)

- Github integration

FishEye (https://www.atlassian.com/software/fisheye/overview)

- Visualize, Review, and organize code changes

Tools

- Testing checks code function via dynamic analysis
- Code reviews manually check code **quality** via static analysis

Automated static analysis (linters) can help as well

- SimpleCov (code coverage, https://github.com/colszowka/simplecov)
- Flog (code complexity, http://ruby.sadi.st/Flog.html)
- Reek (code smells, https://github.com/troessner/reek)
- Cane (code quality, https://github.com/square/cane)
- Rails_best_practices (Rails specific, https://github.com/flyerhzm/rails_best_practices)

Summary

- Reviews are not a new thing, good reasons to do them
- Different types of review techniques
  - Management Review
  - Technical Review
  - Inspection
  - Walk-through
  - Modern / contemporary code reviews
- Method to find faults and improvement opportunities early in the process

Code Examples


```ruby
def self.human_attribute_name(*args)
  if args[0].to_s == "start_date"
    return "Anfangs-Datum"
  elsif args[0].to_s == "end_date"
    return "End-Datum"
  end

  # NOTE: In our quest for 100% code coverage we can't have this line.
  # If anyone is to add a new attribute that uses the default label,
  # reenable this line.
  # super
end
```

Problems?

Should `super` be there or not?

- If yes, test it!

Better

- Don’t override Rails core methods
- Use proper i18n

Code Examples

```
describe "POST #create" do
  context "with valid params" do
    it "creates a new Profile" do
      sign_in FactoryGirl.create(:user)
      expect {
        post :create, profile: valid_attributes, session: valid_session
      }.to change(Profile, :count).by(1)
    end

    it "assigns a newly created profile as @profile" do
      sign_in FactoryGirl.create(:user)
      post :create, profile: valid_attributes, session: valid_session
      expect(assigns(:profile)).to be_a(Profile)
      expect(assigns(:profile)).to be_persisted
    end

    it "redirects to the created profile" do
      sign_in FactoryGirl.create(:user)
      post :create, profile: valid_attributes, session: valid_session
      expect(response).to redirect_to(Profile.last)
    end
  end

  context "with invalid params" do
    it "assigns a newly created but unsaved profile as @profile" do
      sign_in FactoryGirl.create(:user)
      post :create, profile: invalid_attributes, session: valid_session
      expect(assigns(:profile)).to be_a_new(Profile)
    end

    it "re-renders the 'new' template" do
      sign_in FactoryGirl.create(:user)
      post :create, profile: invalid_attributes, session: valid_session
      expect(response).to render_template("new")
```

Problems?

before(:each)

Code Examples


```ruby
# POST /chair_wimis
# POST /chair_wimis.json
def create
  @chair_wimi = ChairWimi.new
  @chair_wimi.chair_id = params[:chair]
  @chair_wimi.user_id = params[:user]

  @chairapp = ChairApplication.find_by(:user_id => params[:user], :chair_id => params[:chair])
  @chairapp.status = 'accepted'
  @chairapp.save

  @user = User.find(params[:user])
  @user.role = 'wimi'
  @user.save
```

Problem?

Parameters don’t match **params**

Business logic vs controller logic

- chair.add_wimi
- chair_application.accept!

Code Examples


```
validates_presence_of :last_name
validates_presence_of :source
validates_inclusion_of :potential, :in => 0..100, :message => " ist in % anzugeben und kan
validates_inclusion_of :status, :in => 1..4, :message => ": 1 - offen | 2 - benachrichtigt
validates_format_of :email, :with => /^(|(([A-Za-z0-9]+_+)|([A-Za-z0-9]+\-+)|([A-Za-z0-9]+

def self.newLead (first_name, last_name, source, potential, status, email, adr_street, adr

  if first_name == nil or last_name == nil or first_name == "" or last_name == ""
    return nil
  end
  if source == nil or source == ""
    return nil
  end
  if potential == nil or potential == "" or potential < 0 or potential > 100
    return nil
  end
  if status == nil or status == "" or status < 1 or status > 4
    return nil
  end

  if email != nil and email != "" and (email =~ /^(|(([A-Za-z0-9]+_+)|([A-Za-z0-9]+\-+)|([
    return nil
  end

  lead = Lead.create(:first_name => first_name, :last_name => last_name, :source => source

  return lead
end
```

Problem?

Re-implements Active Record Validation Logic

Solution:

- lead = Lead.new({ first_name: first_name, last_name: … })
- lead.valid? => false

Code Examples


```ruby
def getSeller
  seller_list=[]
  for s in Seller.find_by_sql ["SELECT name FROM sellers where id = ?",self.seller_id]
    seller_list << Seller.find(s.attributes["name"])
  end
  return seller_list
end
```

Problem?

- Re-implements Active Record Association Logic
- Solution:
  - belongs_to :seller

Code Example


```
def SupportTicket.selectClosedTickets
  result = Array.new
  all.each do |ticket|
    if ticket.closed?
      result << ticket
    end
  end
  return result
end
```

Problem?

- Re-implements Active Record Finder Logic
- Major performance issue
- Violates Ruby coding conventions

- Solution:
  - SupportTicket.find_all_by_closed(true)
  - SupportTicket.where(:closed => true)

Code Example


```ruby
def getActualDiscount
  @customer = self.opportunity.mockup_customer
  if @customer.discount_class == "A"
  @customer_discount = 30
  end
  if @customer.discount_class == "B"
  @customer_discount = 20
  end
  if @customer.discount_class == "C"
  @customer_discount = 10
  end
  return @customer_discount + self.discount
end
```

Problem?

Code is error prone

Violates Ruby coding conventions

- Camelcase methods
- Indentations
- Superfluous instance variable assignments

Solution:

- Test with uncommon values (“D”)
- Suggestion: Move it somewhere else -> Customer?

Code Example


```
def e_r_s (s)
  if s == nil
  return ""
  else
  return s
  end
end
```

Problem?

Self-explanatory method and variable names?
Indent?

Solution:

- Why not use ruby standard functionality
- Ternary operator
- return s.nil? ? "" : s

Code Example


```ruby
it "should belong to a customer" do
  customer = Factory.build(:customer)
  @campaign_response.customer = customer
  @campaign_response.customer.should == customer
end
```

Problems?

Solution:

- Do something with the customer

Code Examples

```ruby
# GET /events/1/ranking
def ranking
  # Array of RankingEntry Structs that gets sorted when filled completely
  @ranking_entries = []

  # Leaves the Array of RankingEntry Structs empty when no teams participate in the event
  @event.teams.each do |team|
    ranking_entry = RankingEntry.new(nil, team.name, 0, 0, 0, 0, 0, 0, 0, 0)

    event_matches = @event.matches
    # Considers only the team's home matches that belong to the event
    home_matches_in_event = team.home_matches & event_matches
    parse_matches_data_into_ranking_entry team, ranking_entry, home_matches_in_event, :parse_match_details_for_home

    # Considers only the team's away matches that belong to the event
    away_matches_in_event = team.away_matches & event_matches
    parse_matches_data_into_ranking_entry team, ranking_entry, away_matches_in_event, :parse_match_details_for_away

    ranking_entry.goals_difference = ranking_entry.goals - ranking_entry.goals_against
    @ranking_entries.push ranking_entry
  end

  # Sorts the RankingEntries in the following order:
  #   1. DESCENDING by points
  #   2. DESCENDING by goals
  #   3. ASCENDING by name
  @ranking_entries = @ranking_entries.sort_by { | ranking_entry | [-ranking_entry.points, -ranking_entry.goals, ranking_entry.

  # Adds a rank to each RankingEntry based on its position in the Array
  @ranking_entries.each_with_index do |ranking_entry, index|
    ranking_entry.rank = index + 1
  end
end
```

Problem?

Looks complicated

- Slim controller?
- Small methods!
- Custom Route (No REST)

Solution:

- Create a PORO (Plain old ruby object)

References

[Bosu'17] Bosu, Amiangshu, et al. "Process Aspects and Social Dynamics of Contemporary Code Review: Insights from Open Source Development and Industrial Practice at Microsoft." *TSE* 43.1 (2017): 56-75.

[McIntosh'14] McIntosh, Shane, et al. "The impact of code review coverage and code review participation on software quality: A case study of the qt, vtk, and itk projects." *MSR'14.*

[Rigby'13] Rigby, Peter C., and Christian Bird. "Convergent contemporary software peer review practices." *FSE'13*.

[Bacchelli'13] Bacchelli, Alberto, and Christian Bird. "Expectations, outcomes, and challenges of modern code review." *ICSE'*13.

[Feitelson'13] Feitelson, Dror G., Eitan Frachtenberg, and Kent L. Beck. "Development and deployment at facebook." *IEEE Internet Computing* 17.4 (2013): 8-17.

Image Sources

- "ScientificReview" by Center for Scientific Review
  Licensed under Public Domain via Wikimedia Commons
  http://commons.wikimedia.org/wiki/File:ScientificReview.jpg
- "WTF per Minute" by Glen Lipka
  http://commadot.com/wtf-per-minute/
- "The Dark Side of Infrastructure as Code" by Lori Macvittie
  https://devops.com/dark-side-infrastructure-code/
- Geek & Poke
  http://geek-and-poke.com/geekandpoke/2010/11/1/how-to-make-a-good-code-review.html