Understanding Confusion in Code Reviews

Felipe Ebert

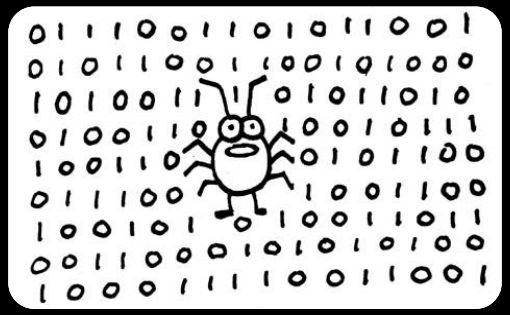
felipe.ebert@gmail.com

Code Review

Who is doing Code Review?

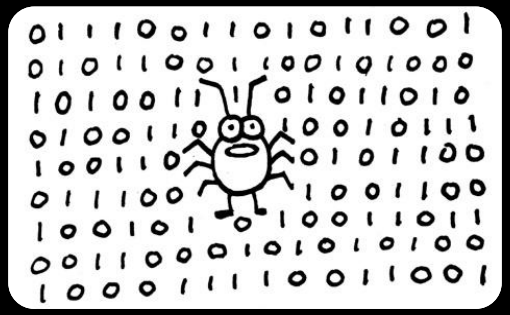

Why?

Why Code Reviewing?!



Find Defects

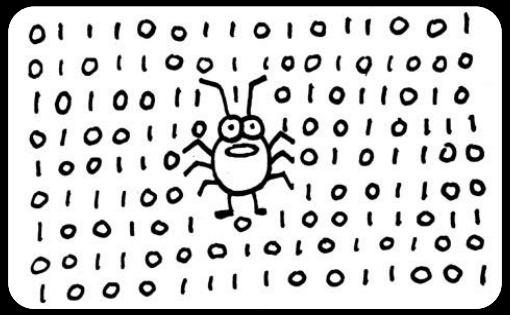
Why Code Reviewing?!



Find Defects

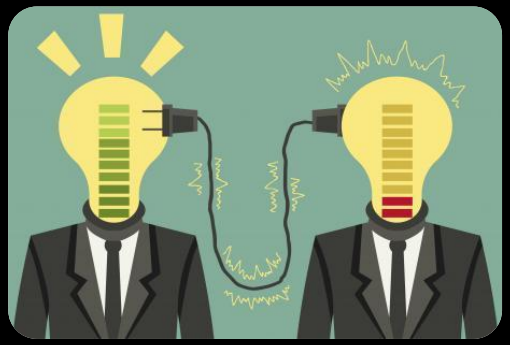
Code Improvement
Alternative Solutions

Why Code Reviewing?!



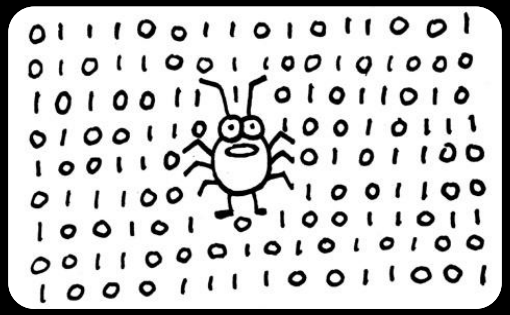
Find Defects

Code Improvement
Alternative Solutions



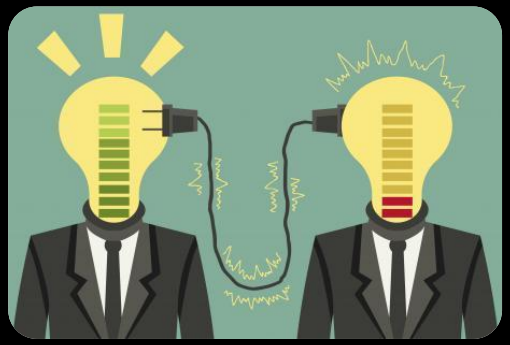
Knowledge Transfer
Team Awareness

Why Code Reviewing?!



Find Defects

Code Improvement
Alternative Solutions

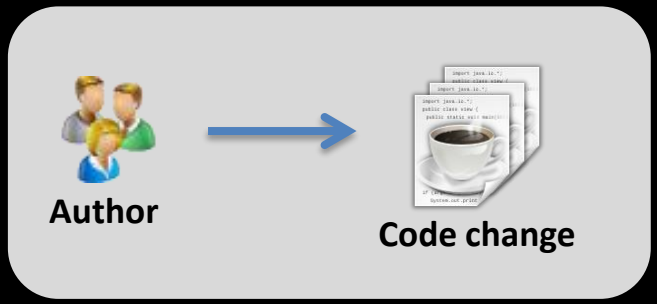


Knowledge Transfer
Team Awareness

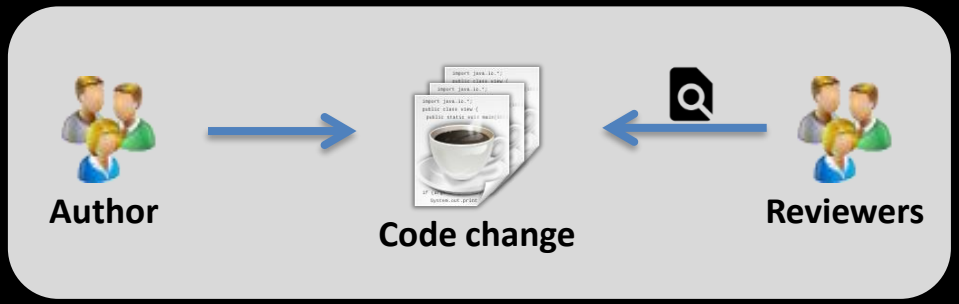
Shared Code
Ownership

Code Review Process

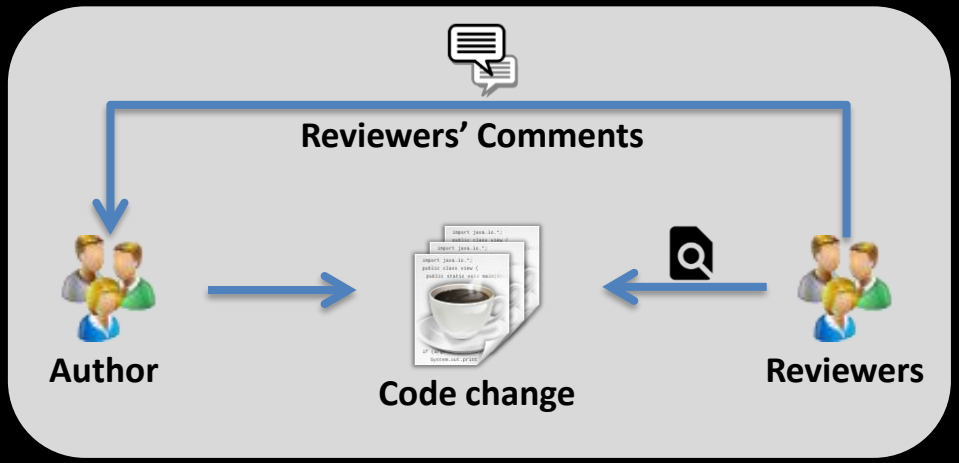
Code Review Process



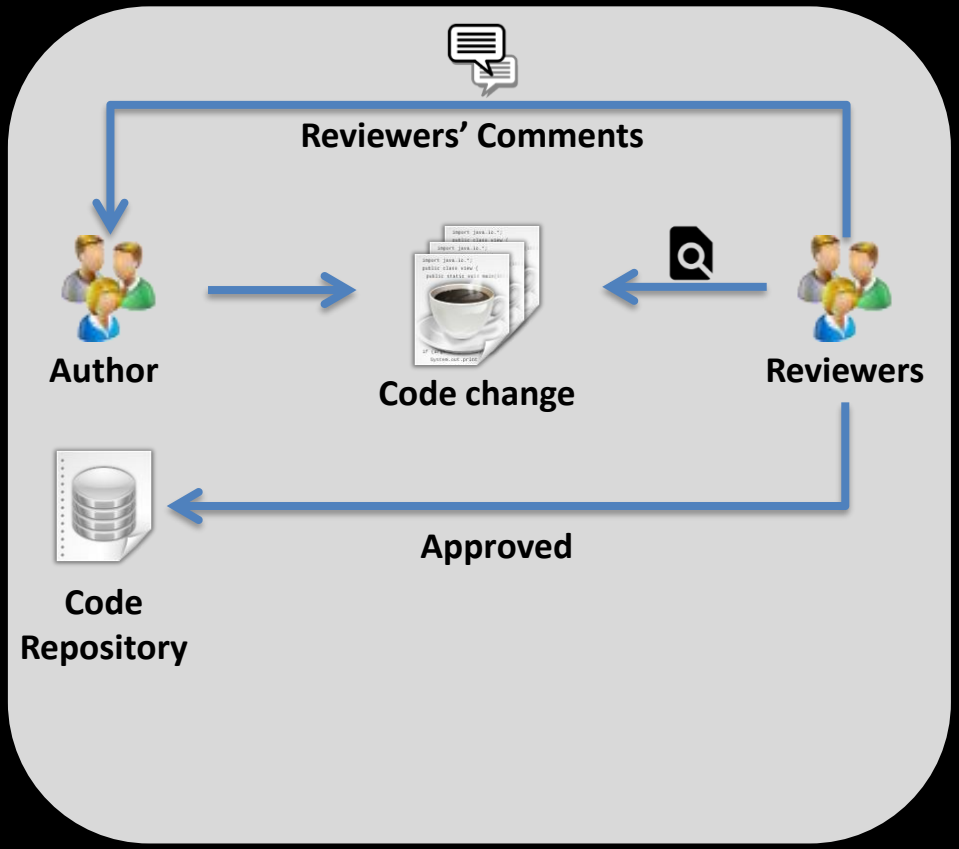
Code Review Process



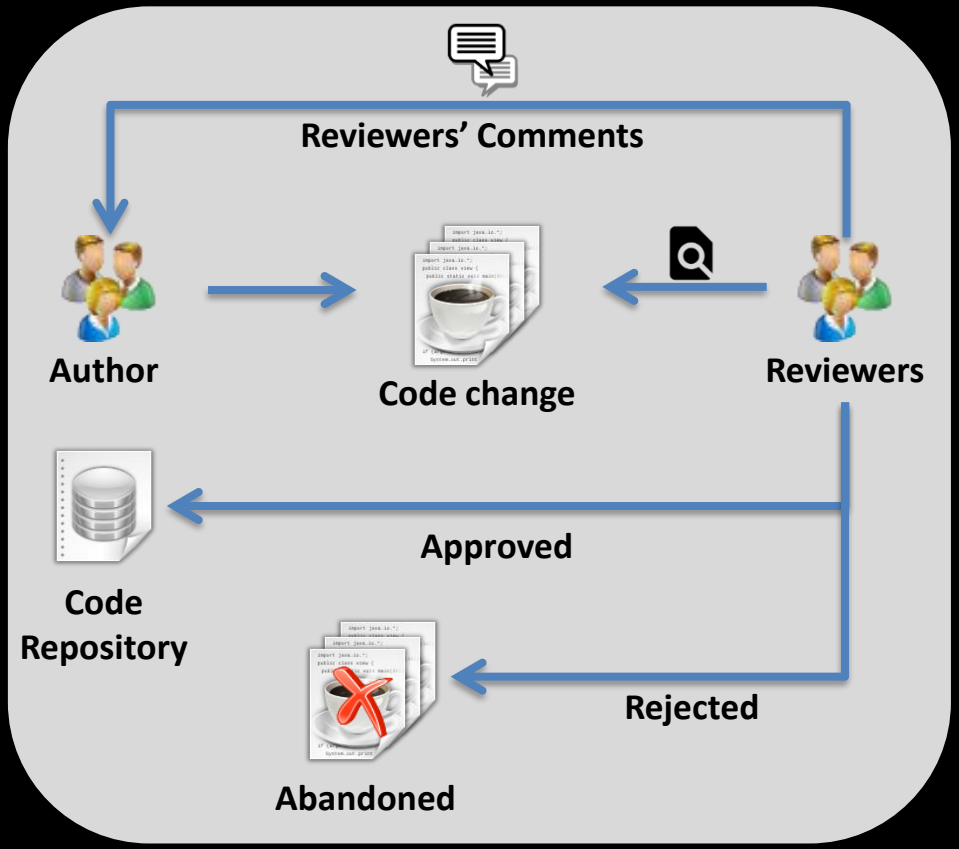
Code Review Process

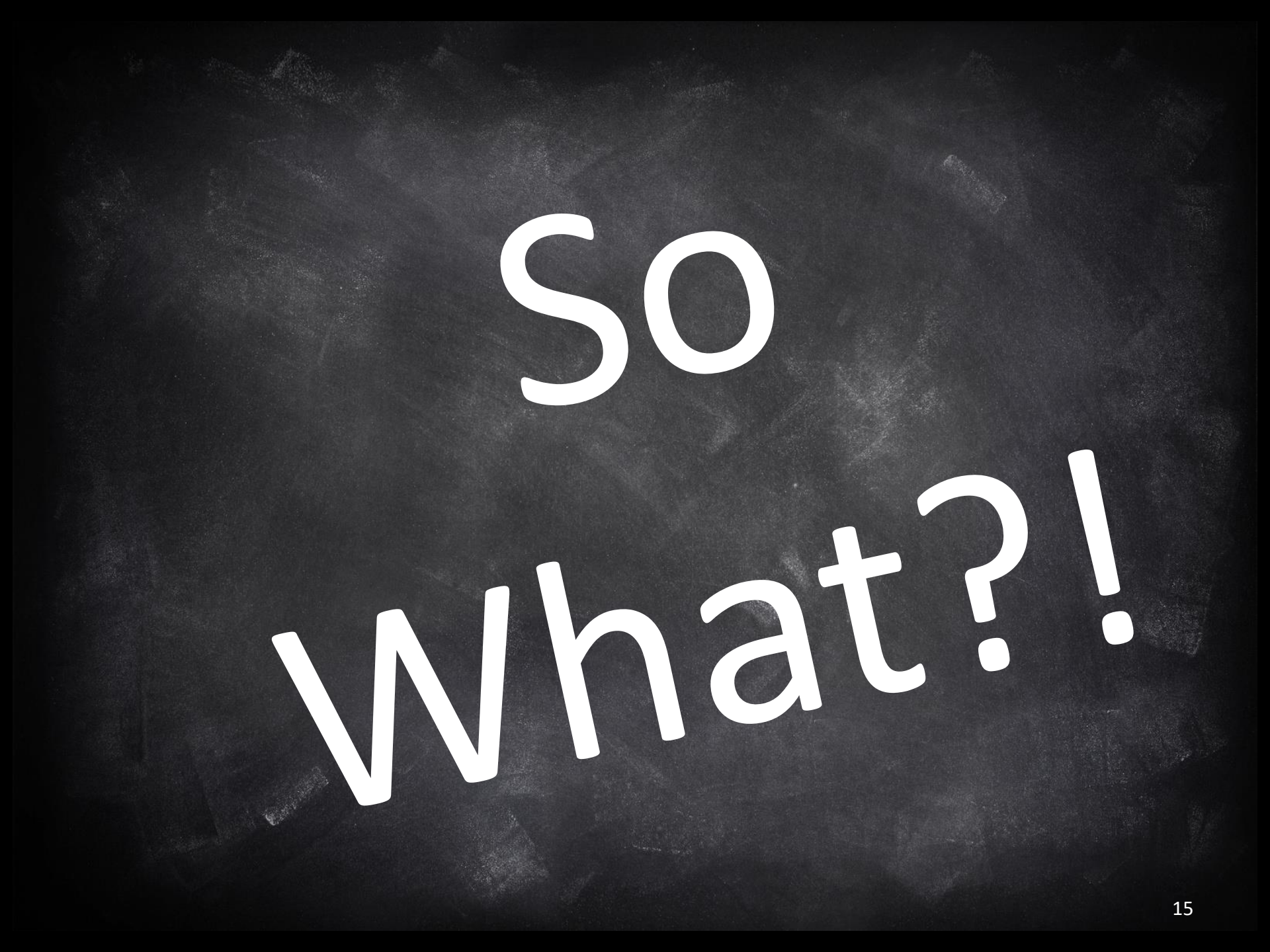


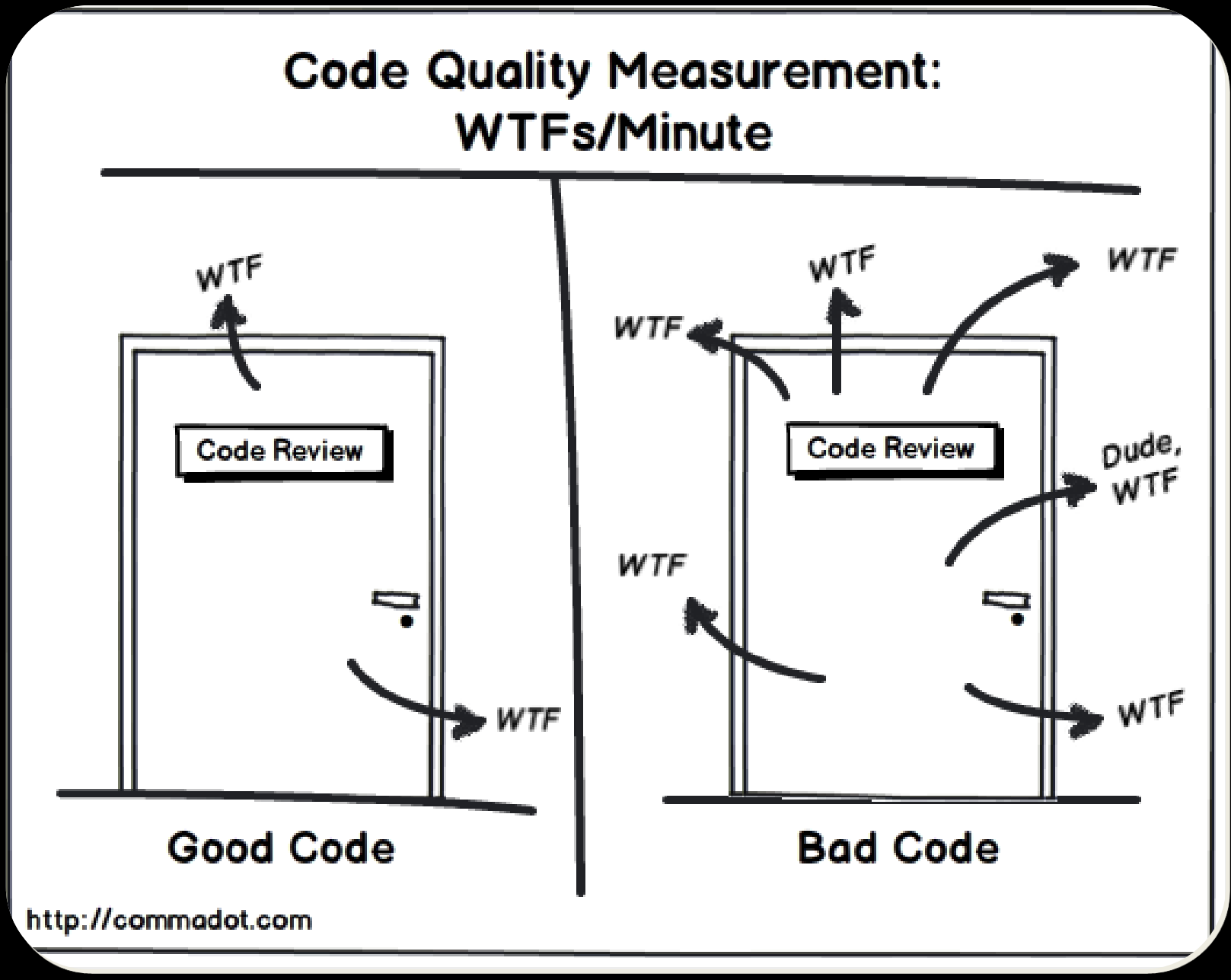
Code Review Process

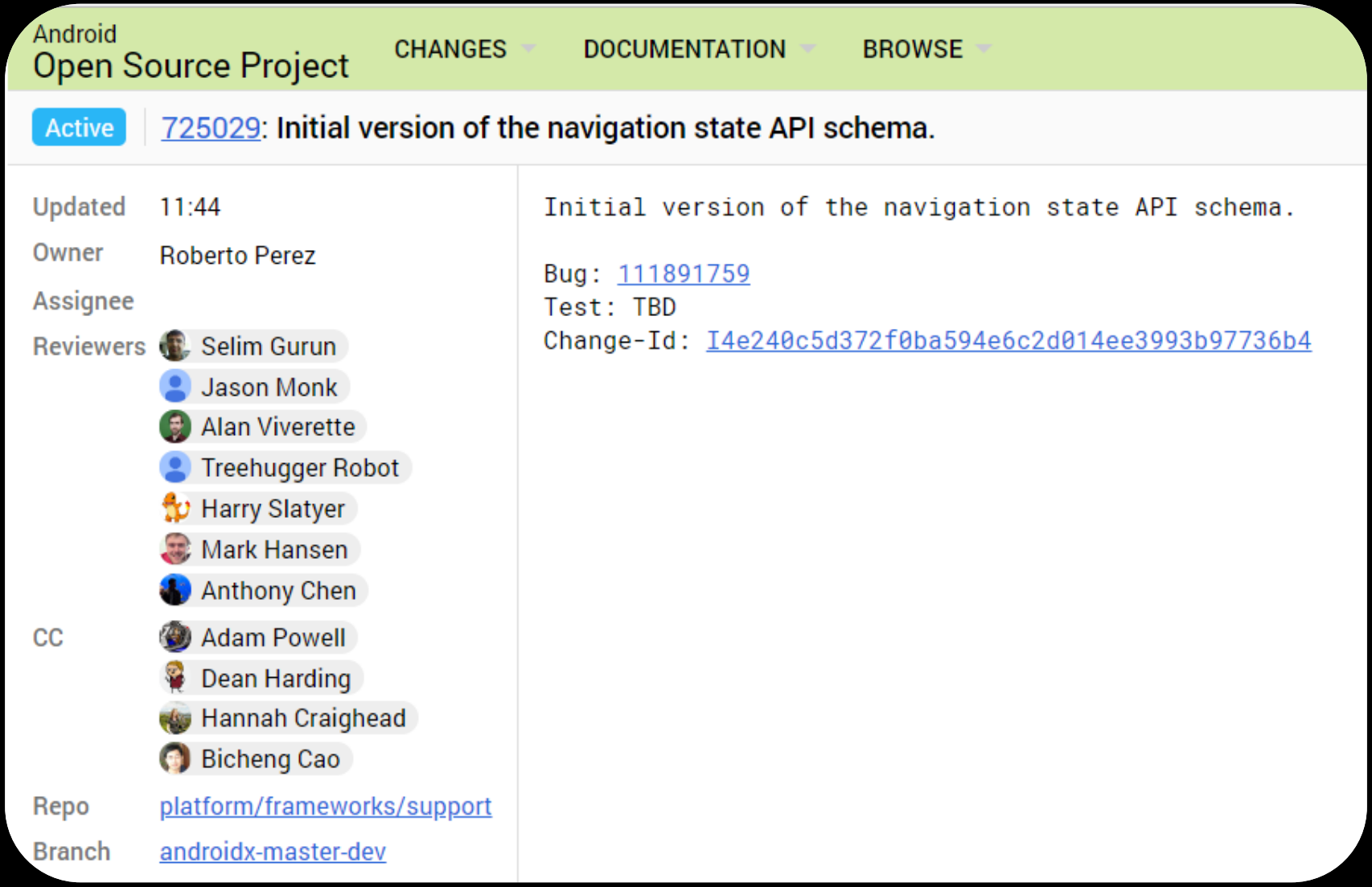


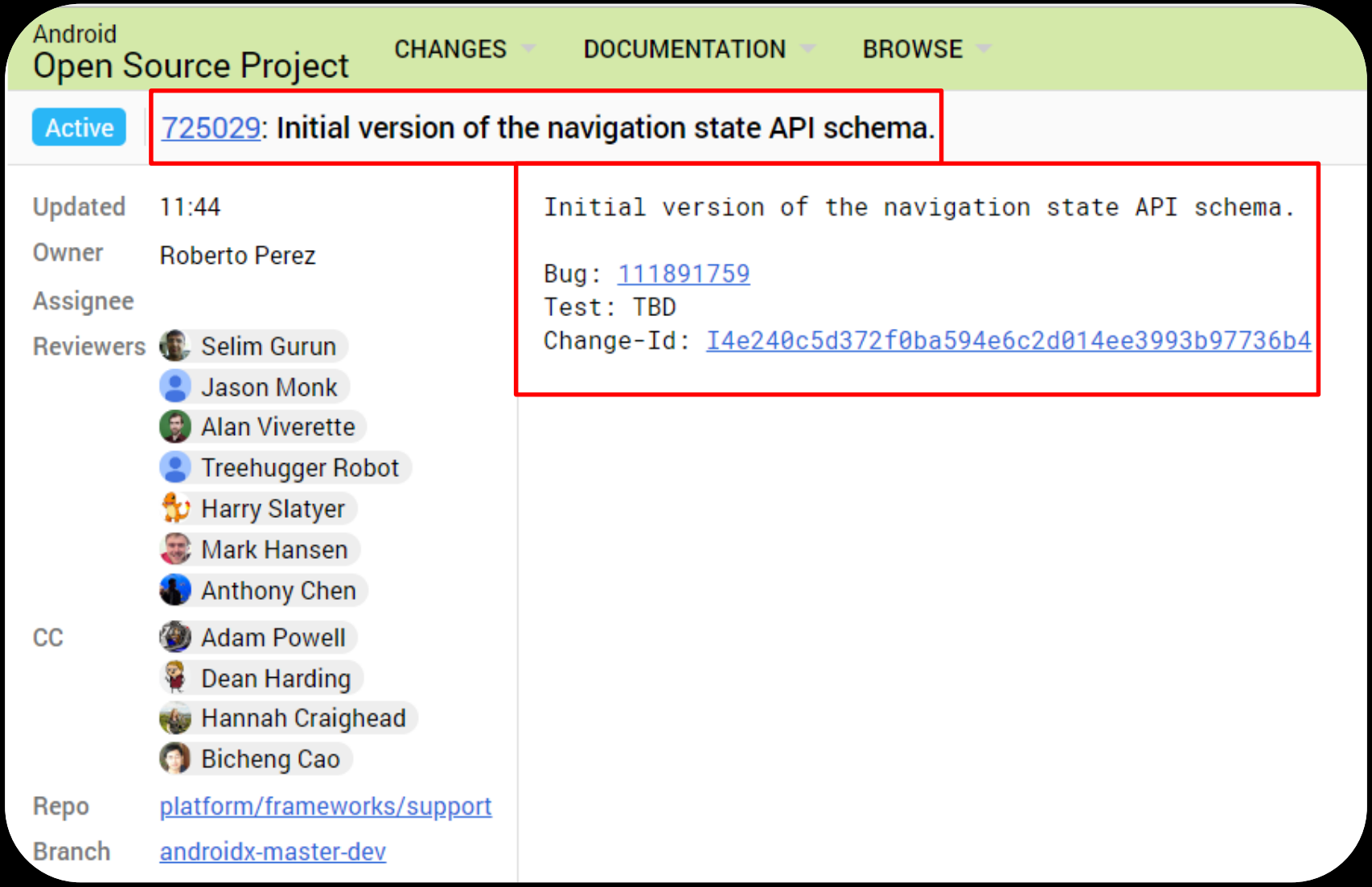
Code Review Process




So
What?!


Code Quality Measurement:
WTFs/Minute
WTF
Code Review
WTF
Good Code
WTF
WTF
WTF
WTF
Code Review
Dude,
WTF
WTF
WTF
Bad Code
http://commadot.com


Android
Open Source Project
CHANGES
DOCUMENTATION
BROWSE
Active
725029: Initial version of the navigation state API schema.
Updated 11:44
Owner Roberto Perez
Assignee
Reviewers Selim Gurun
Jason Monk
Alan Viverette
Treehugger Robot
Harry Slatyer
Mark Hansen
Anthony Chen
CC Adam Powell
Dean Harding
Hannah Craighead
Bicheng Cao
Repo platform/frameworks/support
Branch androidx-master-dev
Initial version of the navigation state API schema.
Bug: 111891759
Test: TBD
Change-Id: I4e240c5d372f0ba594e6c2d014ee3993b97736b4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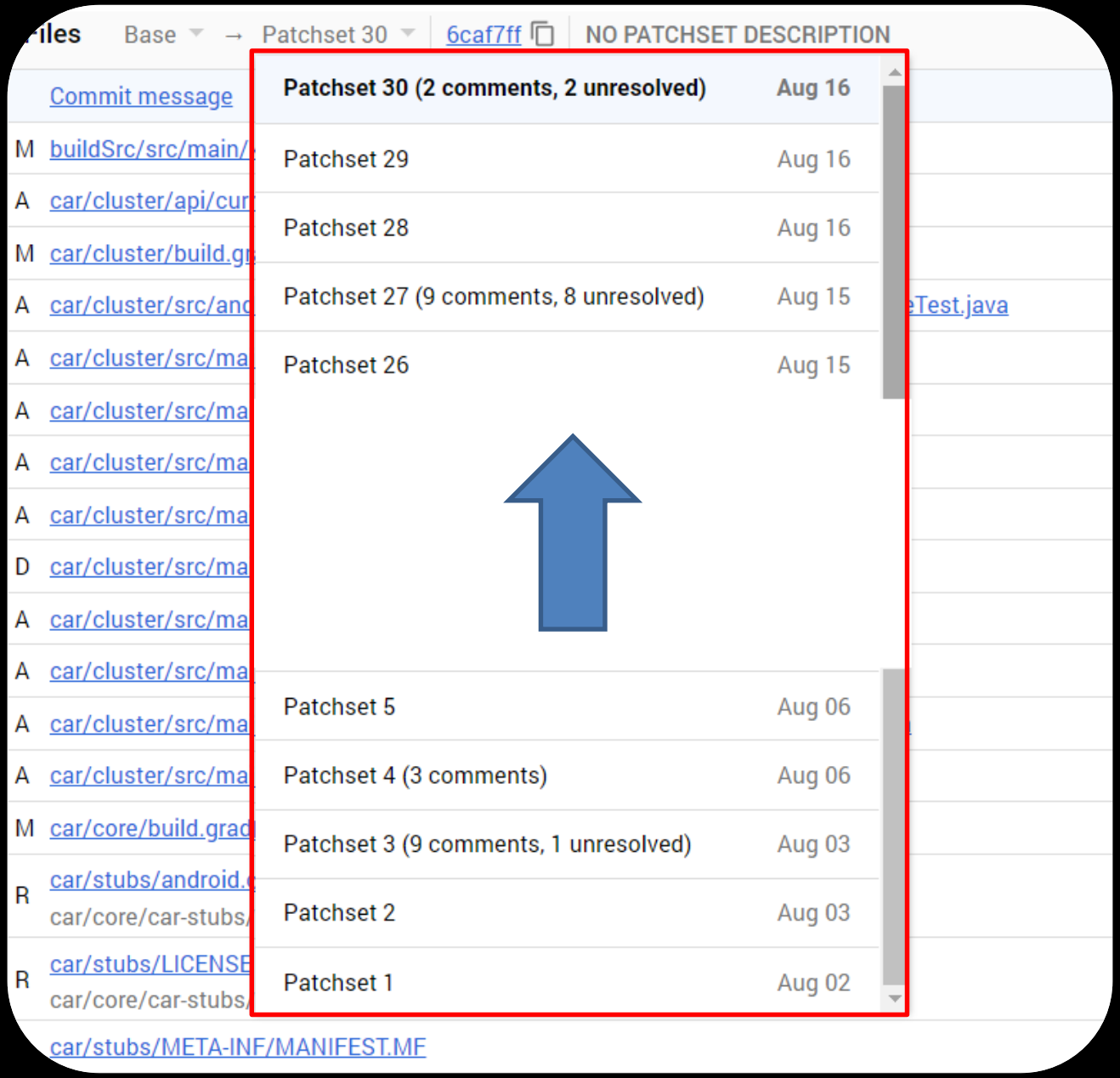
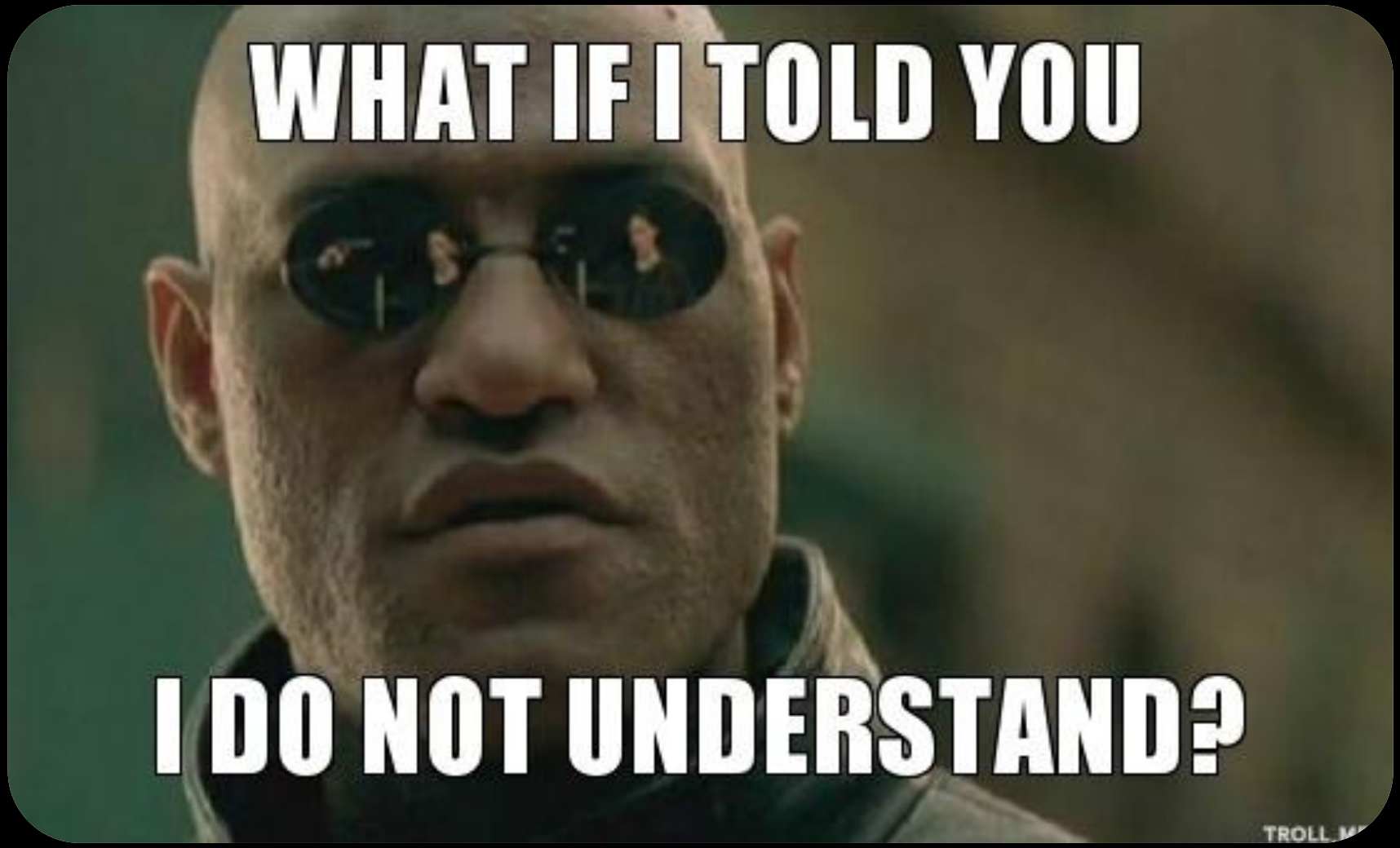
	buildSrc/src/main/kotlin/androidx/build/PublishDocsRules.kt		+1 -1
A	car/cluster/api/current.txt		+126 -0
M	car/cluster/build.gradle		+17 -3
A	car/cluster/src/androidTest/java/androidx/car/cluster/navigation/NavigationStateTest.java		+162 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/Destination.java	1 comment (1 unresolved)	+187 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/Distance.java		+138 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/Maneuver.java		+372 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/NavigationState.java		+136 -0
D	car/cluster/src/main/java/androidx/car/cluster/navigation/Sample.java		+0 -23
A	car/cluster/src/main/java/androidx/car/cluster/navigation/Step.java	1 comment (1 unresolved)	+109 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/util/Common.java		+60 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/util/EnumWrapper.java		+130 -0
A	car/cluster/src/main/java/androidx/car/cluster/navigation/util/Time.java		+96 -0
M	car/core/build.gradle		+2 -2
R	car/stubs/android.car.jar car/core/car-stubs/android.car.jar		+/-0 B (-0%)
R	car/stubs/LICENSE car/core/car-stubs/LICENSE		+0 -0
A	car/stubs/META-INF/MANIFEST.MF		+3 -0
R	car/stubs/README.android car/core/car-stubs/README.android		+0 -0
M	versionedparcelable/annotation/src/main/java/androidx/versionedparcelable/compiler/VersionedParcelProcessor.java		+16 -10
			+1555 -39

Code change size = 1.594 LOC

```
        formattedNumber = format(numberNoExt, PhoneNumberFormat.NATIONAL);
      }
    } else {
      // For non-geographical countries, and Mexican and Chilean fixed line and mobile numbers, we
      // output international format for numbers that can be dialed internationally as that always
      // works.
      if ((regionCode.equals(REGION_CODE_FOR_NON_GEO_ENTITY)
          // MX fixed line and mobile numbers should always be formatted in international format,
          // even when dialed within MX. For national format to work, a carrier code needs to be
          // used, and the correct carrier code depends on if the caller and callee are from the
          // same local area. It is trickier to get that to work correctly than using
          // international format, which is tested to work fine on all carriers.
          // CL fixed line numbers need the national prefix when dialing in the national format,
          // but don't have it when used for display. The reverse is true for mobile numbers.  As
          // a result, we output them in the international format to make it work.
          || ((regionCode.equals("MX") || regionCode.equals("CL"))
          && isFixedLineOrMobile))
          && canBeInternationallyDialled(numberNoExt)) {
        formattedNumber = format(numberNoExt, PhoneNumberFormat.INTERNATIONAL);
      } else {
        formattedNumber = format(numberNoExt, PhoneNumberFormat.NATIONAL);
      }
    }
  } else if (isValidNumber && canBeInternationallyDialled(numberNoExt)) {
    // We assume that short numbers are not diallable from outside their region, so if a number
    // is not a valid regular length phone number, we treat it as if it cannot be internationally
    // dialled.
@@                +10↑ - Show 2055 common lines - +10↓
```

```
        formattedNumber = format(numberNoExt, PhoneNumberFormat.NATIONAL);
      }
    } else {
      // For non-geographical countries, and Mexican, Chilean, and Uzbek fixed line and mobile
      // numbers, we output international format for numbers that can be dialed internationally as
      // that always works.
      if ((regionCode.equals(REGION_CODE_FOR_NON_GEO_ENTITY)
          // MX fixed line and mobile numbers should always be formatted in international format,
          // even when dialed within MX. For national format to work, a carrier code needs to be
          // used, and the correct carrier code depends on if the caller and callee are from the
          // same local area. It is trickier to get that to work correctly than using
          // international format, which is tested to work fine on all carriers.
          // CL fixed line numbers need the national prefix when dialing in the national format,
          // but don't have it when used for display. The reverse is true for mobile numbers.  As
          // a result, we output them in the international format to make it work.
          // UZ mobile and fixed-line numbers have to be formatted in international format or
          // prefixed with special codes like 03, 04 (for fixed-line) and 05 (for mobile) for
          // dialling successfully from mobile devices. As we do not have complete information on
          // special codes and to be consistent with formatting across all phone types we return
          // the number in international format here.
          || ((regionCode.equals("MX") || regionCode.equals("CL")
              || regionCode.equals("UZ")) && isFixedLineOrMobile))
          && canBeInternationallyDialled(numberNoExt)) {
        formattedNumber = format(numberNoExt, PhoneNumberFormat.INTERNATIONAL);
      } else {
        formattedNumber = format(numberNoExt, PhoneNumberFormat.NATIONAL);
      }
    }
  } else if (isValidNumber && canBeInternationallyDialled(numberNoExt)) {
    // We assume that short numbers are not diallable from outside their region, so if a number
    // is not a valid regular length phone number, we treat it as if it cannot be internationally
    // dialled.
@@                +10↑ - Show 2055 common lines - +10↓
```


iles
Base
→
Patchset 30
6caf7ff
NO PATCHSET DESCRIPTION
Commit message
M buildSrc/src/main/
A car/cluster/api/cur
M car/cluster/build.gr
A car/cluster/src/and
A car/cluster/src/ma
A car/cluster/src/ma
A car/cluster/src/ma
A car/cluster/src/ma
D car/cluster/src/ma
A car/cluster/src/ma
A car/cluster/src/ma
A car/cluster/src/ma
A car/cluster/src/ma
M car/core/build.grad
R car/stubs/android.
car/core/car-stubs/
R car/stubs/LICENSE
car/core/car-stubs/
car/stubs/META-INF/MANIFEST.MF
eTest.java
Patchset 30 (2 comments, 2 unresolved) Aug 16
Patchset 29 Aug 16
Patchset 28 Aug 16
Patchset 27 (9 comments, 8 unresolved) Aug 15
Patchset 26 Aug 15
Patchset 5 Aug 06
Patchset 4 (3 comments) Aug 06
Patchset 3 (9 comments, 1 unresolved) Aug 03
Patchset 2 Aug 03
Patchset 1 Aug 02


WHAT IF I TOLD YOU
I DO NOT UNDERSTAND?

ar/cluster/src/main/java/androidx/car/cluster/navigation/StepCue.java#32 *Patchset 25*

Mark Hansen Aug 15 ▼

Could we give some more examples - maybe 3? I'm not sure I completely understand what I should put in here, or as a user, what this might mean.

Roberto Perez Aug 15 ▼

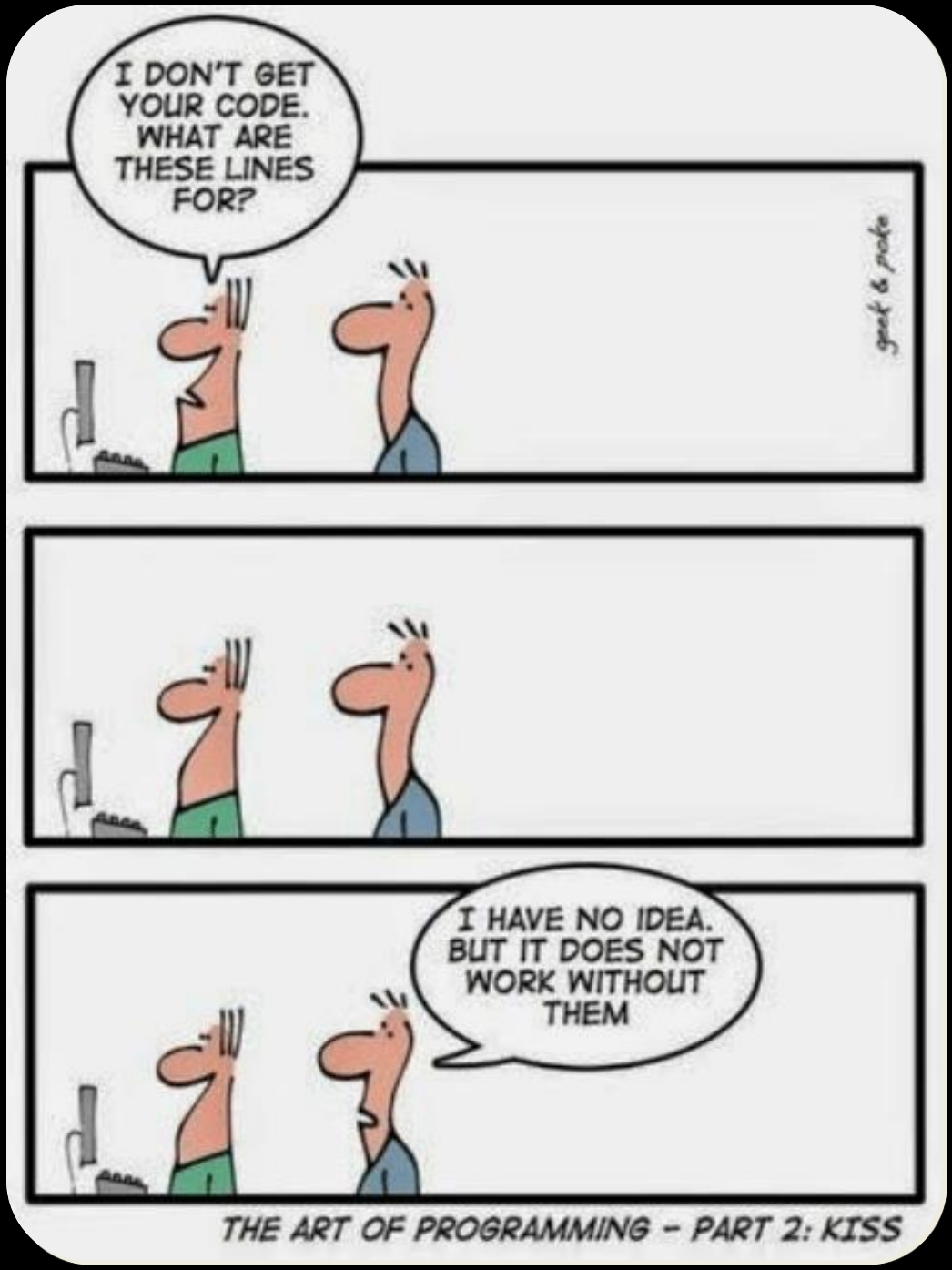
I would ask you to check this with Harry. I'm not sure what the examples would be and you guys are the domain experts here ;-).
In my opinion, this object is useless as is. The proto on path finder has a lot more interesting data for rendering:
https://cs.corp.google.com/piper///depot/google3/maps/pathfinder/client/step.proto?rcl=198890032&l=127.

Please let's take advantage that you and Harry are in the same timezone to set this questions within the same day.

Another class to drop until we have more details on what we want?

To study confusion in code reviews, its manifestations, causes, and impacts

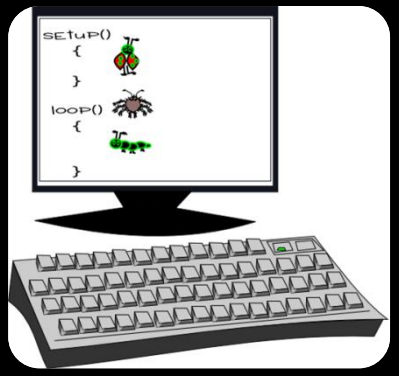
Why confusion?!



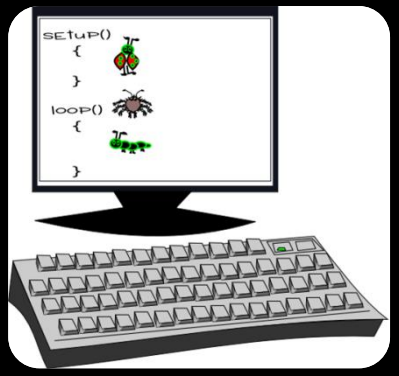
Why confusion?!

Why confusion?!

Why confusion?!

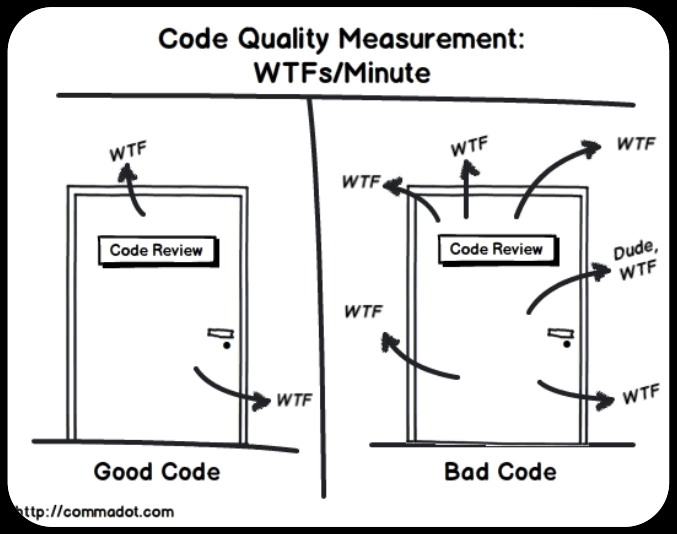


Why confusion?!



What is confusion?!

any situation in which people are **uncertain** about what to do or are **unable to understand** something clearly



Patch Set 2: Code-Review+2

*Though **I don't really understand** why ValueObject moved to runtime...*

Patch Set 1:

***What's the context?** Is this fixing/improving existing code? Could you use the assembler tests for it?*

***why do you need any pixels here?** as I understand, nullptr could be OK here, as this is an output, not input texture*

Provide the code documentation

Reviewers

Patch Set 2: Code-Review+2

*Though **I don't really understand** why ValueObject moved to runtime...*

Guidelines with best practices on coding and submitting for review

Authors

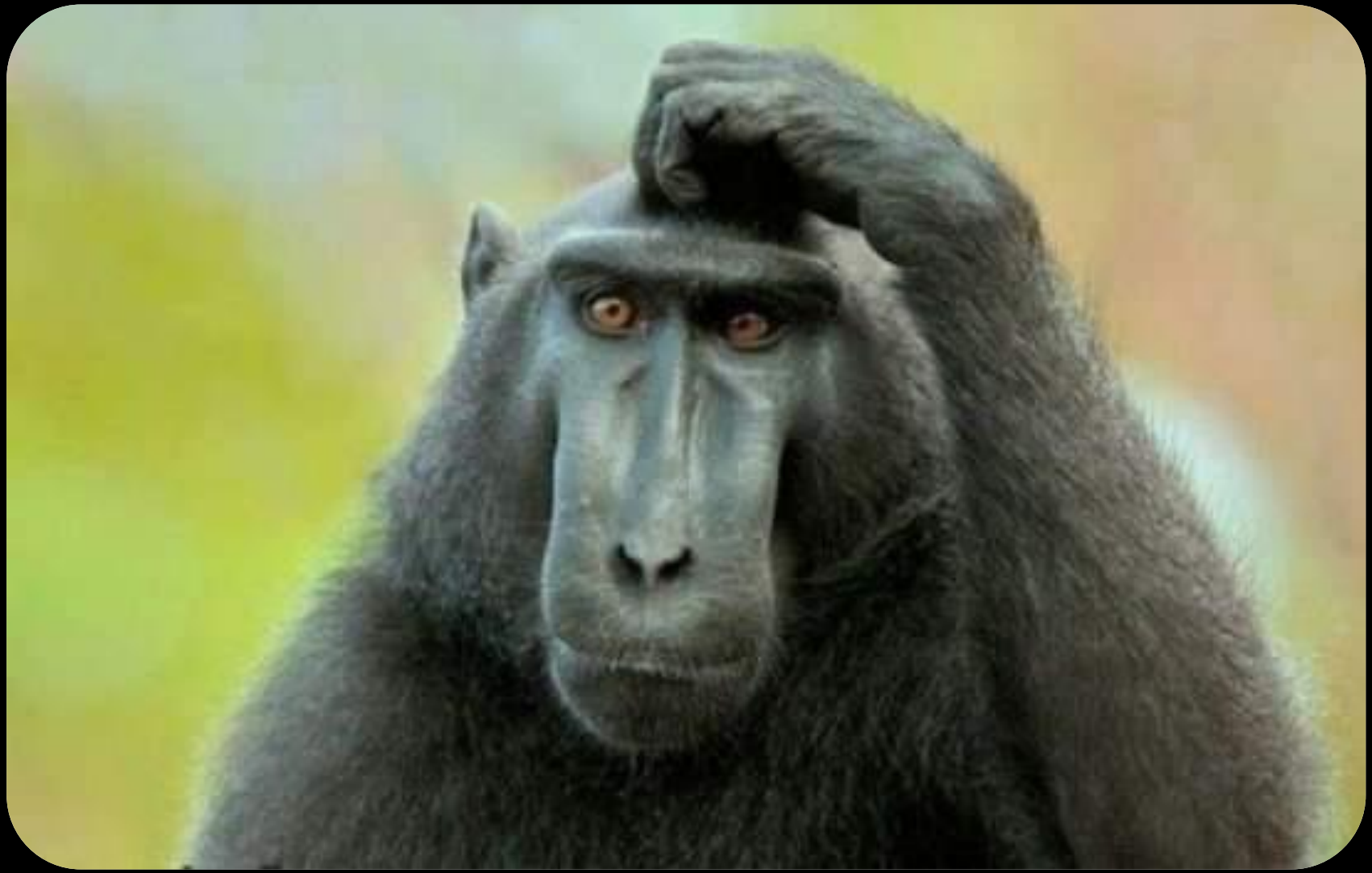
Patch Set 1:

***What's the context?** Is this fixing/improving existing code? Could you use the assembler tests for it?*

Provide other parts of the code

Reviewers

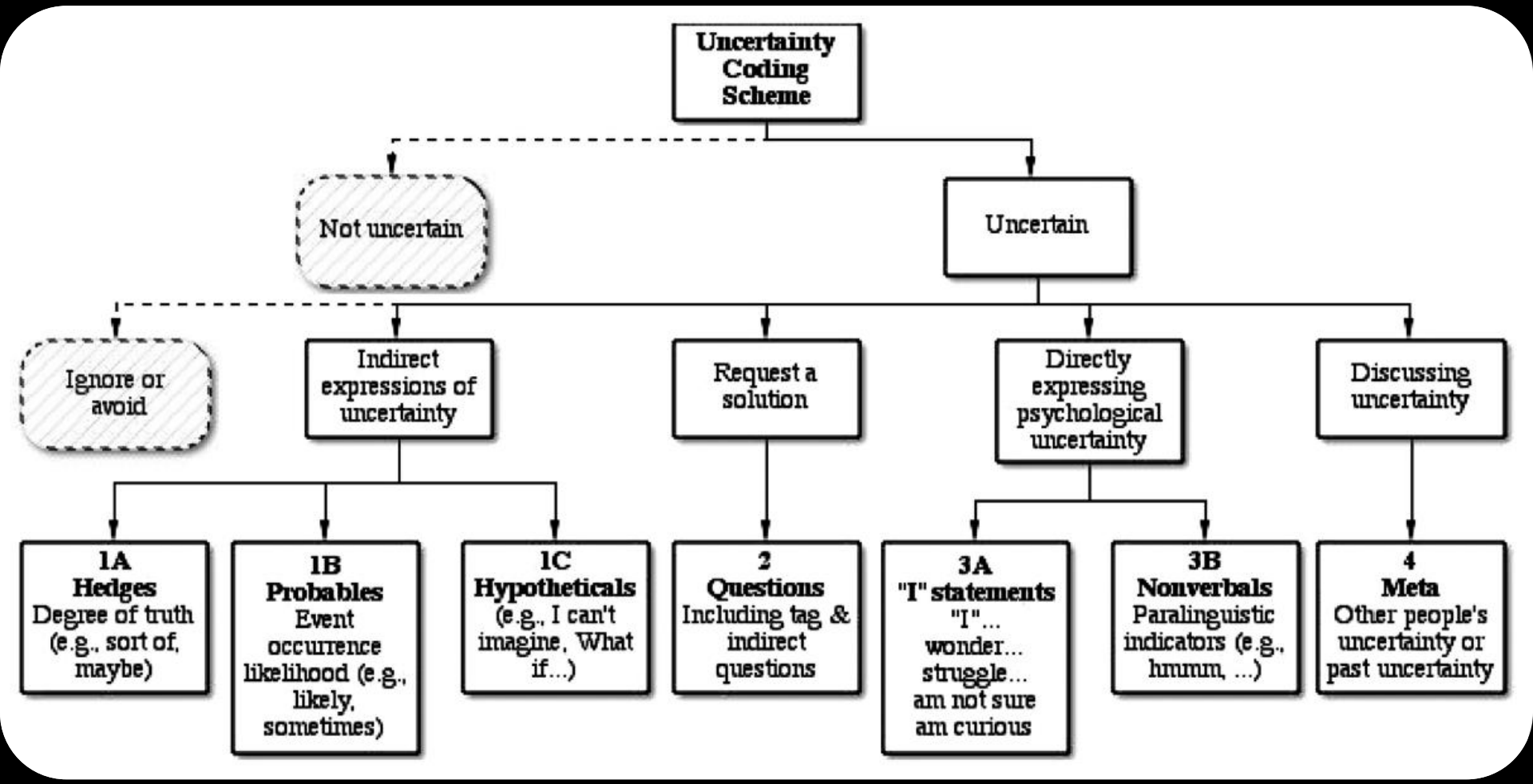
***why do you need any pixels here?** as I understand, nullptr could be OK here, as this is an output, not input texture*



How to identify confusion?

Confusion Detection in Code Reviews

1st Study



Michelle E. Jordan et al., "Expressing uncertainty in computer-mediated discourse: Language as a marker of intellectual work," Discourse Processes, vol. 49, no. 8, pp. 660–692, 2012.

Data Set

android

comments
660,845 GC
232,471 IC

140,006
code reviews

GC – General Comment
IC – Inline Comment

Data Set

android

comments
660,845 GC
232,471 IC

140,006
code reviews

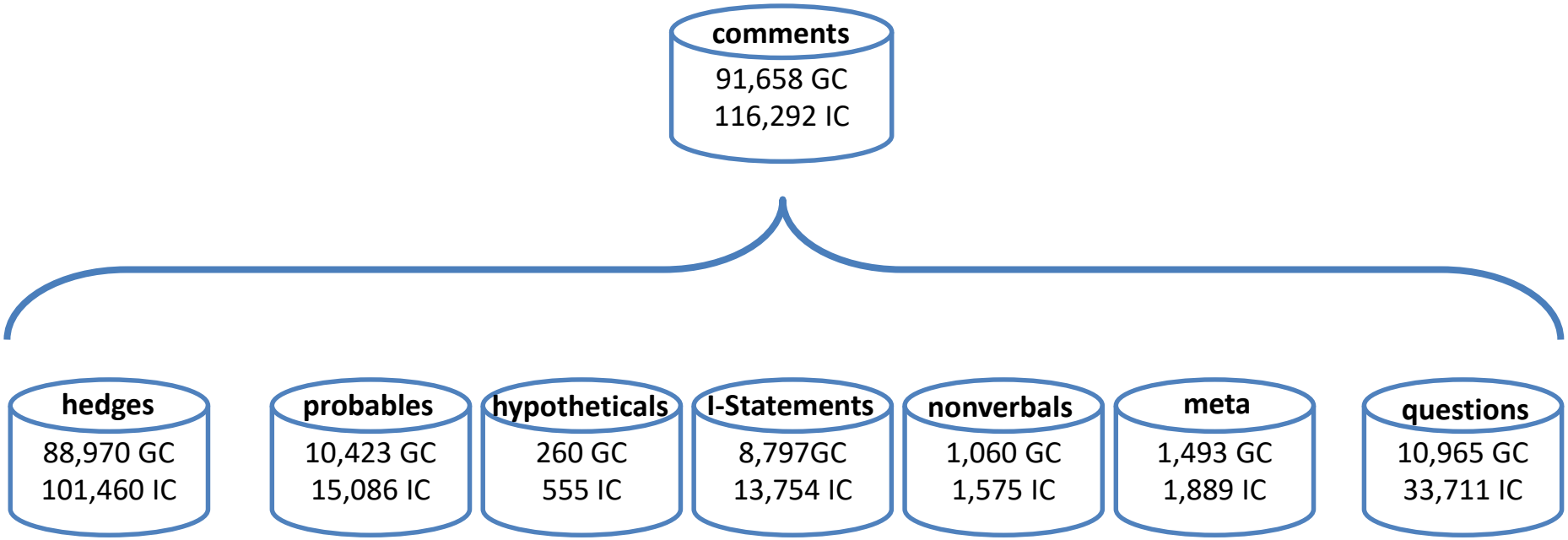
Filtering

Jordan's scheme

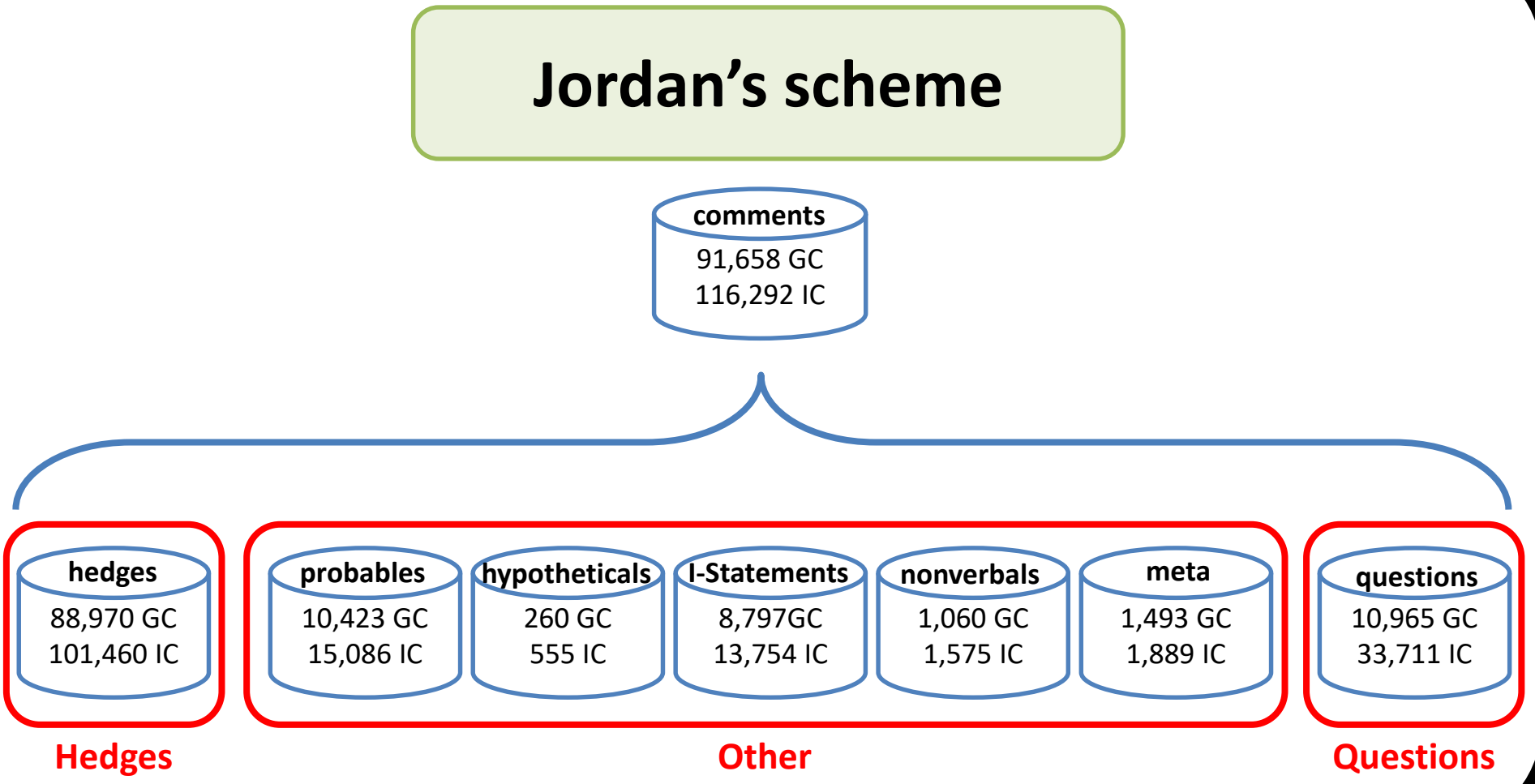
comments
91,658 GC
116,292 IC

Filtering

Jordan's scheme



Filtering


Jordan's scheme
comments
91,658 GC
116,292 IC
hedges
88,970 GC
101,460 IC
probables
10,423 GC
15,086 IC
hypotheticals
260 GC
555 IC
I-Statements
8,797GC
13,754 IC
nonverbals
1,060 GC
1,575 IC
meta
1,493 GC
1,889 IC
questions
10,965 GC
33,711 IC
Hedges
Other
Questions

Data Set

android

comments
660,845 GC
232,471 IC

140,006
code reviews

Filtering

Jordan's scheme

comments
91,658 GC
116,292 IC

Maybe *write a comment with the XML format here*

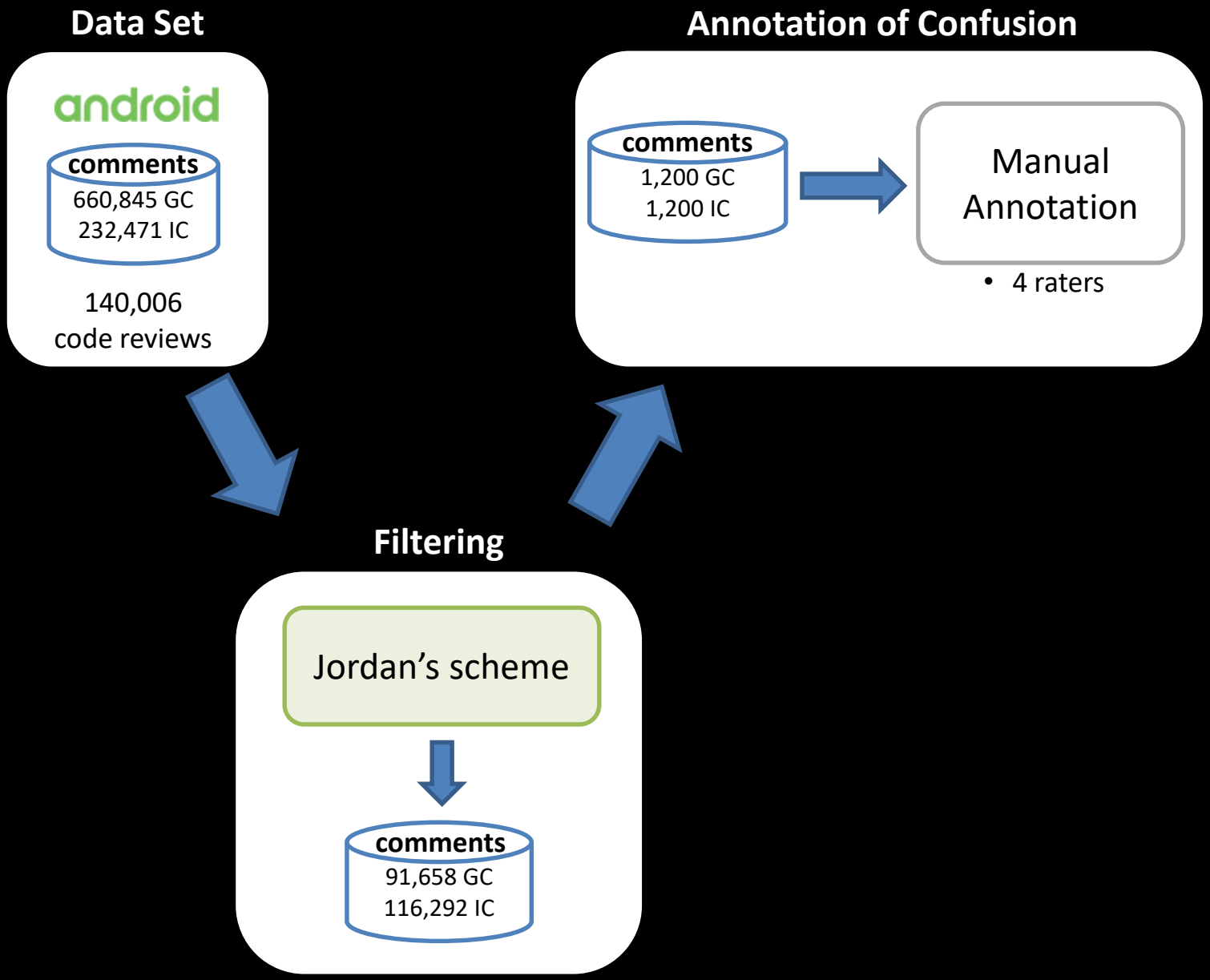
no confusion!

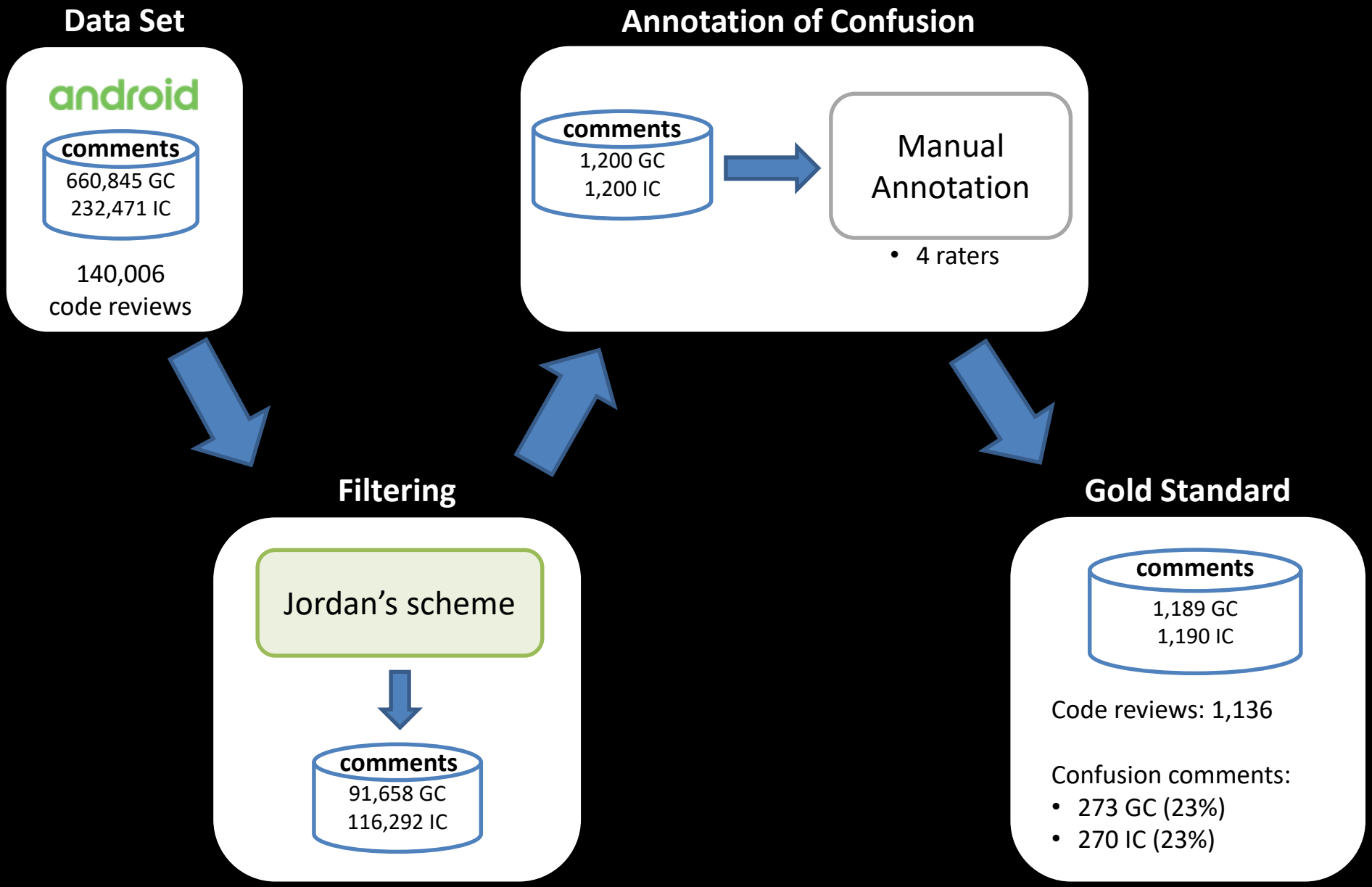
Patch Set 1: ***Could*** *anyone submit this?*

no confusion!

Patch Set 5: Svet: ***Could*** *you please review?*

no confusion!


Data Set
android
comments
660,845 GC
232,471 IC
140,006
code reviews
Annotation of Confusion
comments
1,200 GC
1,200 IC
Manual
Annotation
• 4 raters
Filtering
Jordan's scheme
comments
91,658 GC
116,292 IC


Data Set
android
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code reviews
Annotation of Confusion
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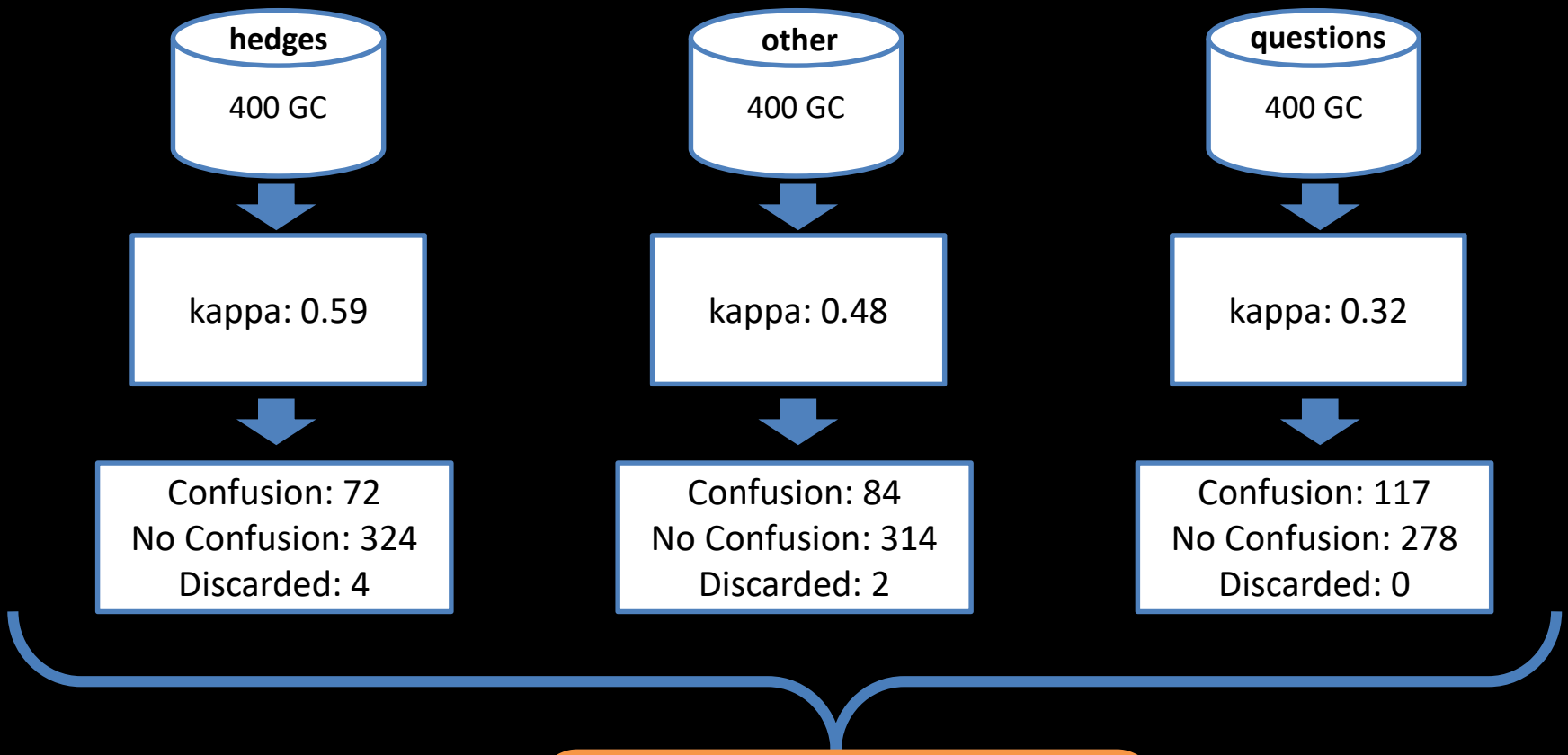
1,200 GC
1,200 IC
Manual
Annotation
• 4 raters
Filtering
Jordan's scheme
comments
91,658 GC
116,292 IC
Gold Standard
comments
1,189 GC
1,190 IC
Code reviews: 1,136
Confusion comments:
• 273 GC (23%)
• 270 IC (23%)

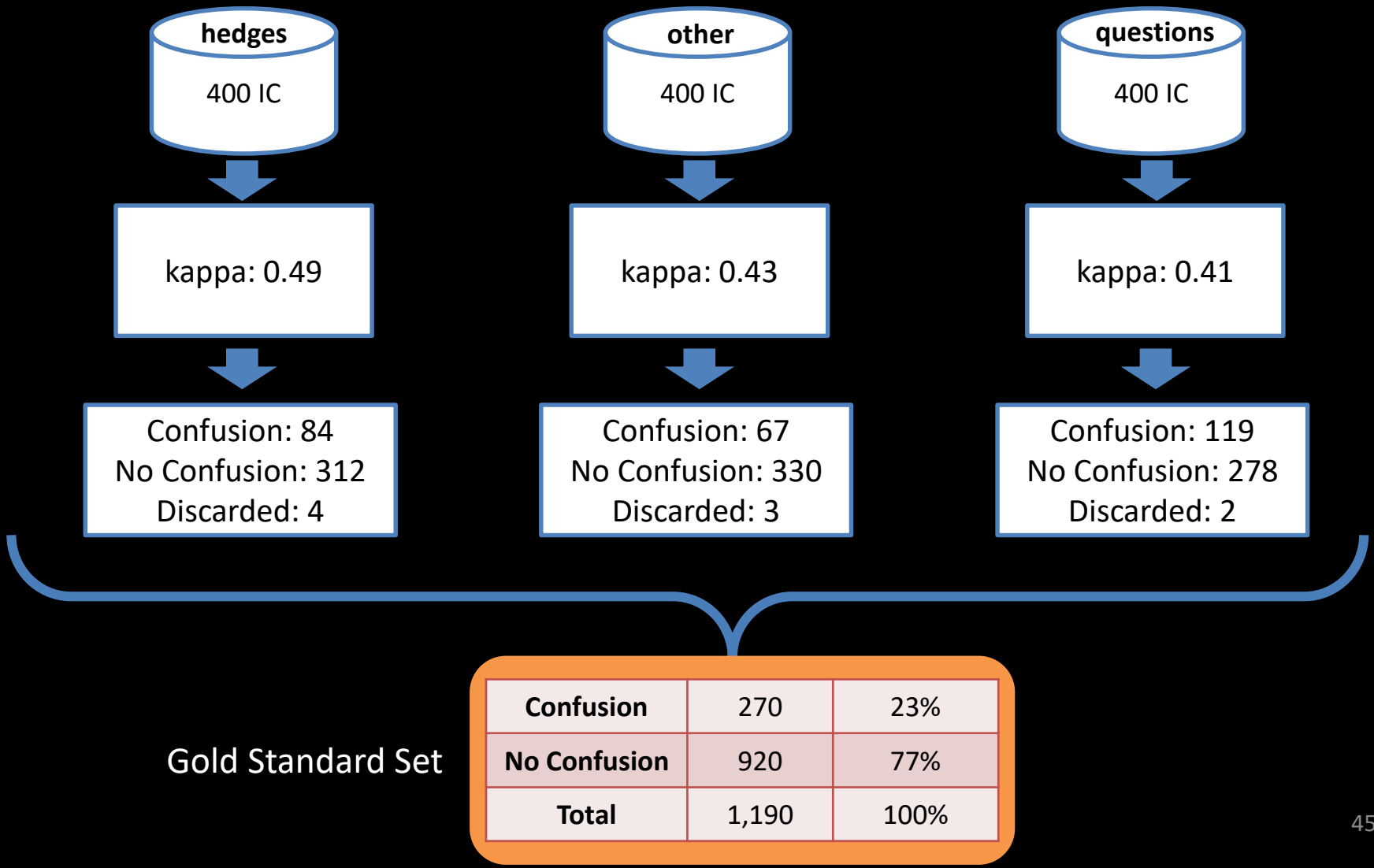
Manual Annotation - GC



Gold Standard Set
(1,136 code reviews)

Confusion	273	23%
No Confusion	916	77%
Total	1,189	100%

Manual Annotation - IC



Gold Standard Set

Confusion	270	23%
No Confusion	920	77%
Total	1,190	100%


12

Precision

		P	R	F
OneR	**GC**	**.875**	.194	.318
	IC	**.615**	.095	.165

Recall

		P	R	F
Multinomial Naive Bayes	**GC**	.209	**.944**	.342
	IC	.234	**.988**	.378

Precision and Recall

		P	R	F
JRip	**GC**	**.696**	**.542**	.609
Logistic	**IC**	**.434**	**.583**	.497

Precision

		P	R	F
OneR	**GC**	**.875**	.194	.318
	IC	**.615**	.095	.165

Recall

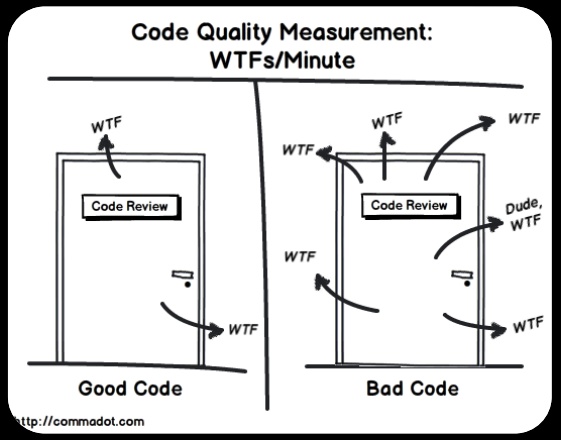
		P	R	F
Multinomial Naive Bayes	**GC**	.209	**.944**	.342
	IC	.234	**.988**	.378

Precision and Recall

		P	R	F
JRip	**GC**	**.696**	**.542**	.609
Logistic	**IC**	**.434**	**.583**	.497

1st Study – Main Takeaways

- Automatic detection of confusion:
  - Feasible task
  - Gold standard set



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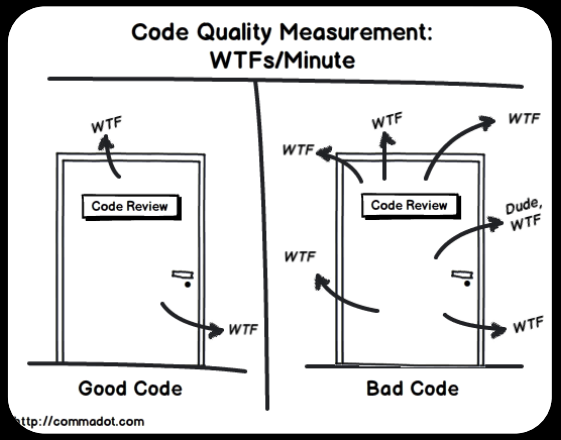
- Confusion detection framework



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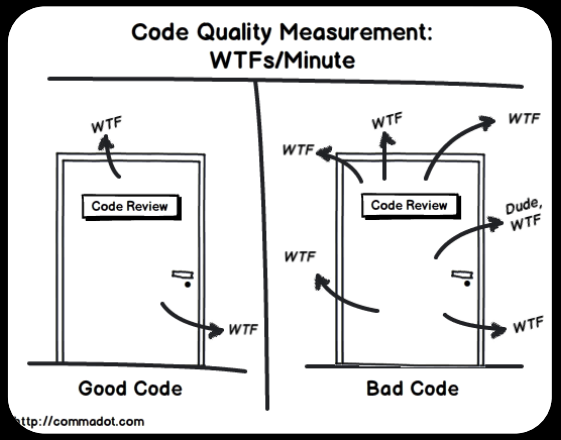
  - Inline comments
  - Questions



1st Study – Main Takeaways

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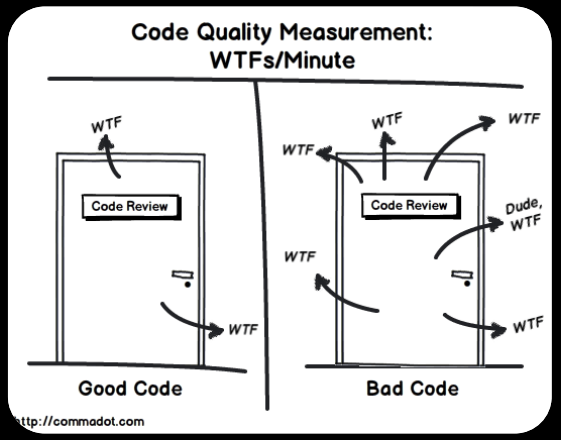
  - Feasible task
  - Gold standard set
- Confusion detection framework
- Harder to identify confusion:
  - Inline comments
  - Questions
- “no-confusion” comments:
  - Suggestions
  - Politeness



Confusion in Context

Reasons
Impacts
Coping strategies

2nd Study

Methodology

“what developer say”

/cluster/src/main/java/androidx/car/cluster/navigation/ProducerStatus.java:

Line 51: The purpose of this class (ProducerStatus) is to allow the producer to send a status to the consumer for it to be displayed. The consumer doesn't need to do anything special about any of these values. All it needs to do is to display this to the user in whichever way matches their UX design.

This class was the "Notice" string before (e.g. "Re-routing"). By making this an enum the consumer has better opportunity to understand what they mean and represent this signal in the most convenient way (or completely ignore it if they wish).

In any case: I agree with Harry, for the sake of speed I'm removing this enum from the CL.

car/cluster/src/main/java/androidx/car/cluster/navigation/Side.java:

Line 20: Moved inside LaneDirection.

car/cluster/src/main/java/androidx/car/cluster/navigation/StepCue.java:

Line 32: I would ask you to check this with Harry. I'm not sure what the examples would be and you guys are the domain experts here ;-).
In my opinion, this object is useless as is. The proto on path finder has a lot more interesting data for rendering:
https://cs.corp.google.com/piper///depot/google3/maps/pathfinder/client/step.proto?rcl=198890032&l=127.

Please let's take advantage that you and Harry are in the same timezone to set this questions within the same day.

Another class to drop until we have more details on what we want?

car/cluster/src/main/java/androidx/car/cluster/navigation/Time.java:

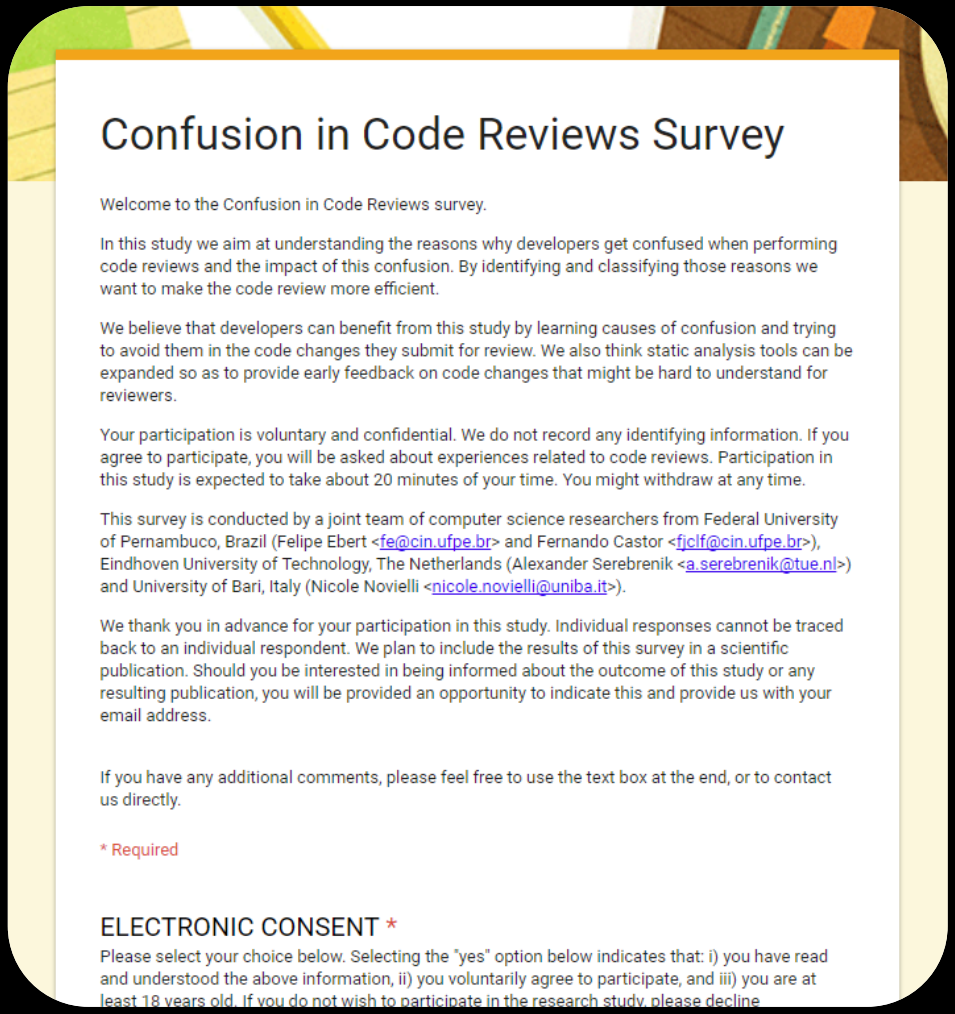
Line 37: Done

“what developer do”

Survey

- **How often** do you feel confused...?
- **What** usually makes you confused...?
- What is the **impact** of confusion…?
- What do you usually do to **overcome** confusion…?

Fist Survey



Confusion in Code Reviews Survey

Welcome to the Confusion in Code Reviews survey.

In this study we aim at understanding the reasons why developers get confused when performing code reviews and the impact of this confusion. By identifying and classifying those reasons we want to make the code review more efficient.

We believe that developers can benefit from this study by learning causes of confusion and trying to avoid them in the code changes they submit for review. We also think static analysis tools can be expanded so as to provide early feedback on code changes that might be hard to understand for reviewers.

Your participation is voluntary and confidential. We do not record any identifying information. If you agree to participate, you will be asked about experiences related to code reviews. Participation in this study is expected to take about 20 minutes of your time. You might withdraw at any time.

This survey is conducted by a joint team of computer science researchers from Federal University of Pernambuco, Brazil (Felipe Ebert <fe@cin.ufpe.br> and Fernando Castor <fjclf@cin.ufpe.br>), Eindhoven University of Technology, The Netherlands (Alexander Serebrenik <a.serebrenik@tue.nl>) and University of Bari, Italy (Nicole Novielli <nicole.novielli@uniba.it>).

We thank you in advance for your participation in this study. Individual responses cannot be traced back to an individual respondent. We plan to include the results of this survey in a scientific publication. Should you be interested in being informed about the outcome of this study or any resulting publication, you will be provided an opportunity to indicate this and provide us with your email address.

If you have any additional comments, please feel free to use the text box at the end, or to contact us directly.

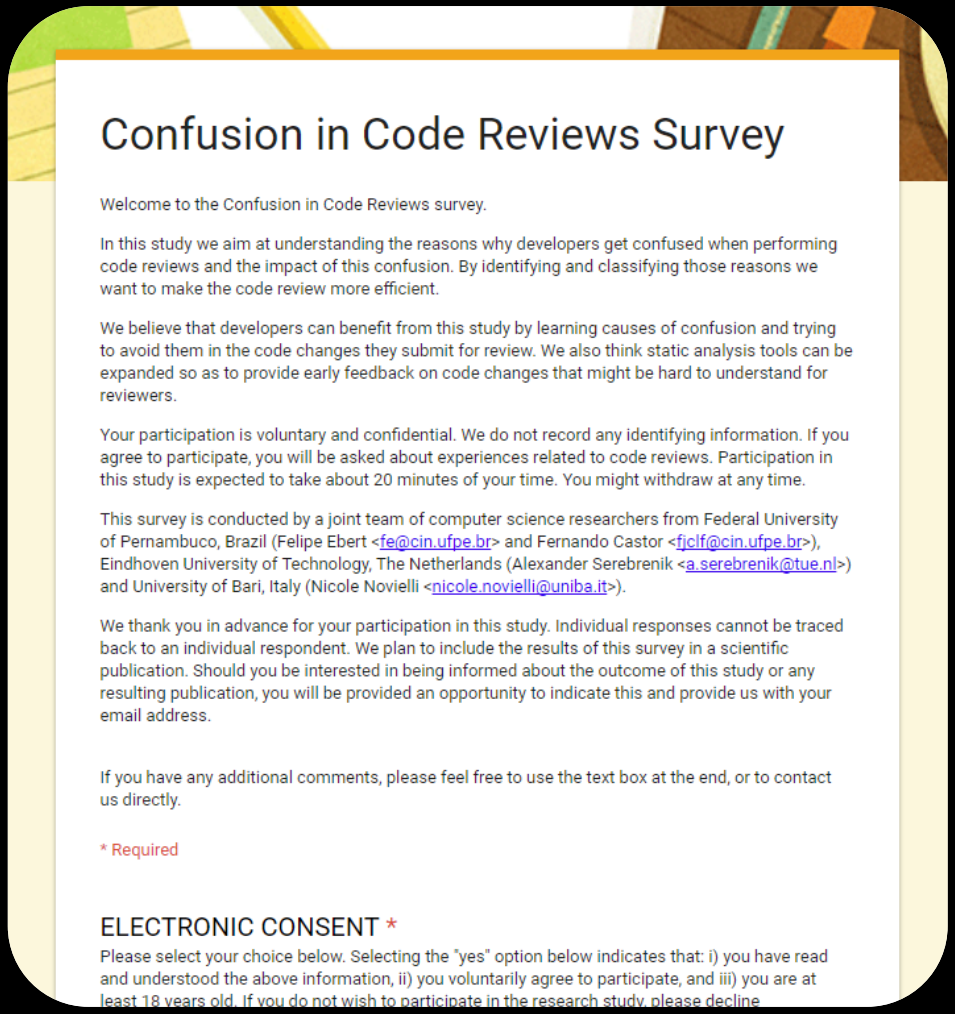
* Required

ELECTRONIC CONSENT *

Please select your choice below. Selecting the "yes" option below indicates that: i) you have read and understood the above information, ii) you voluntarily agree to participate, and iii) you are at least 18 years old. If you do not wish to participate in the research study, please decline

- Emails sent: 4,645
  - Deliverable: 3,765
  - Undeliverable: 880
- Responses: ???

Fist Survey



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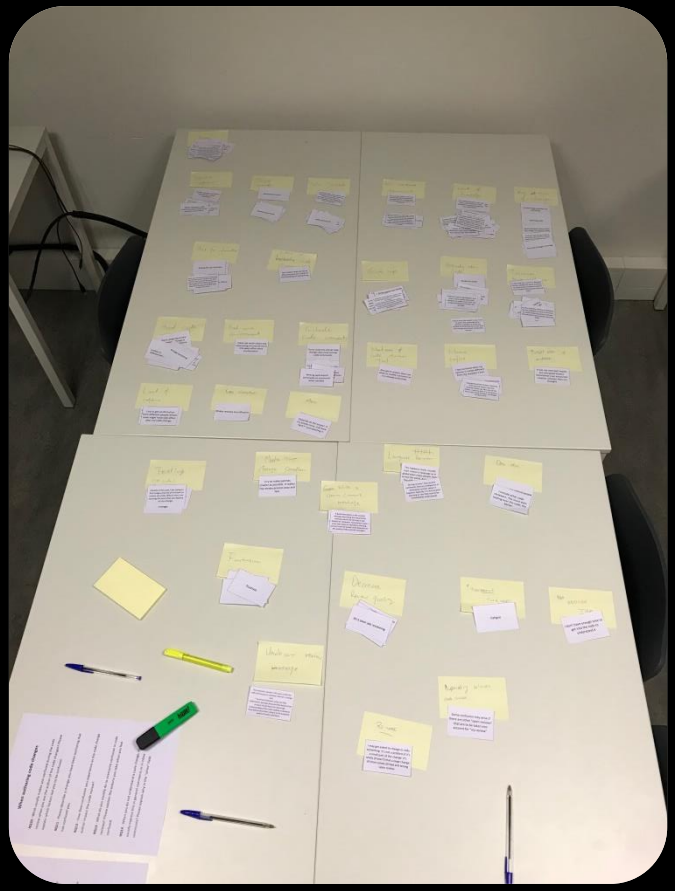
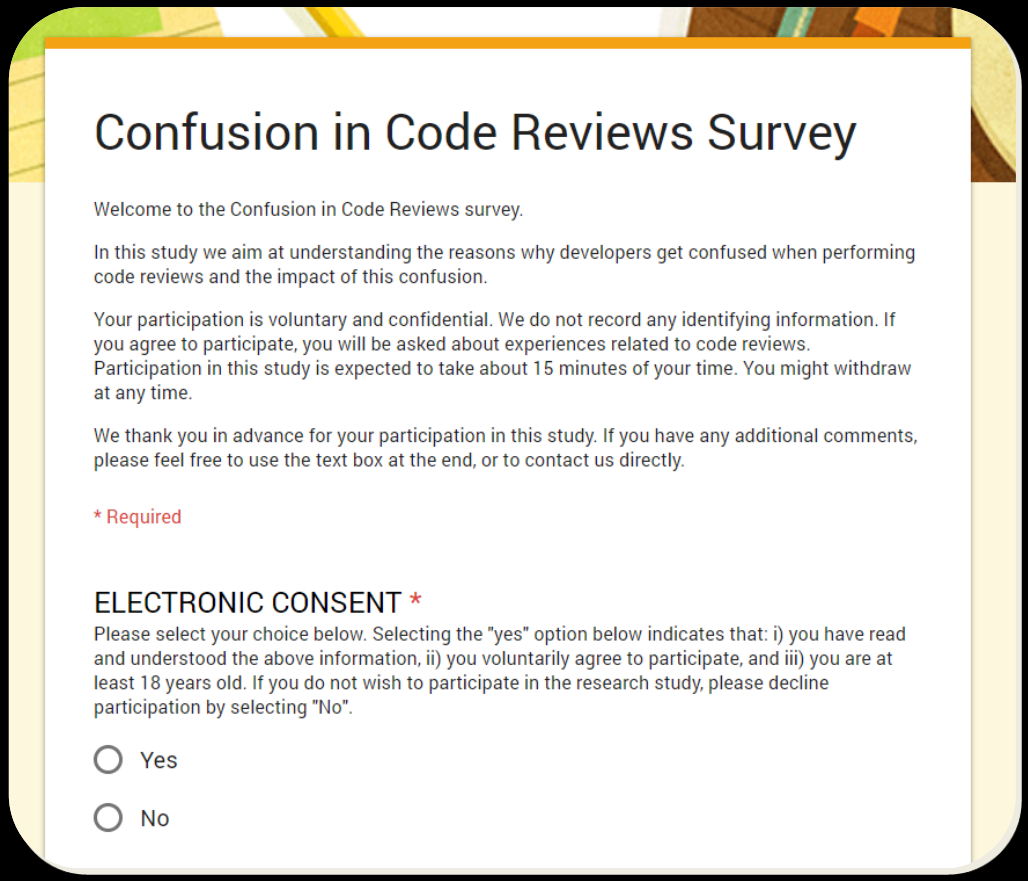
Card Sorting - open



Second Survey



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- ○ Yes
- ○ No

- Open survey:
  - Twitter
  - Facebook
- Responses: 24

Card Sorting – closed

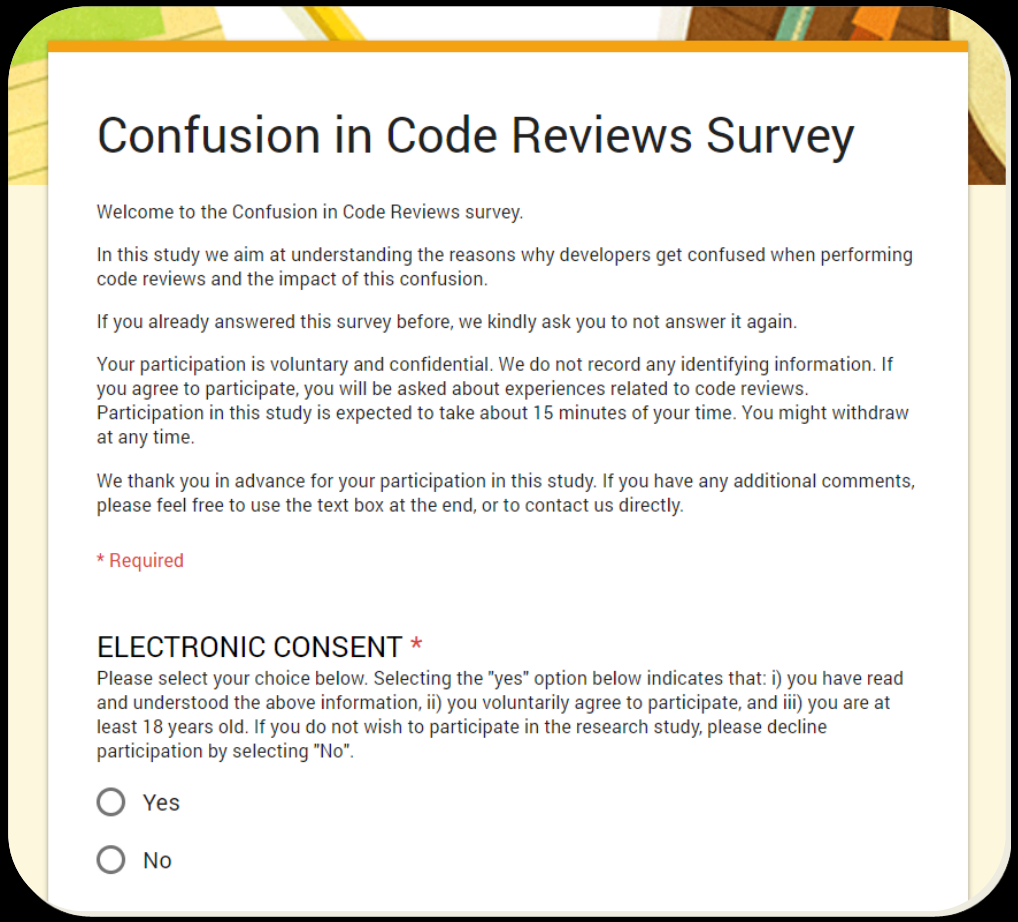
Problem: saturation!!!

1st Survey Results

2nd Survey Results

3 new topics emerged in the 2nd card sorting

Third Survey



Confusion in Code Reviews Survey

Welcome to the Confusion in Code Reviews survey.

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If you already answered this survey before, we kindly ask you to not answer it again.

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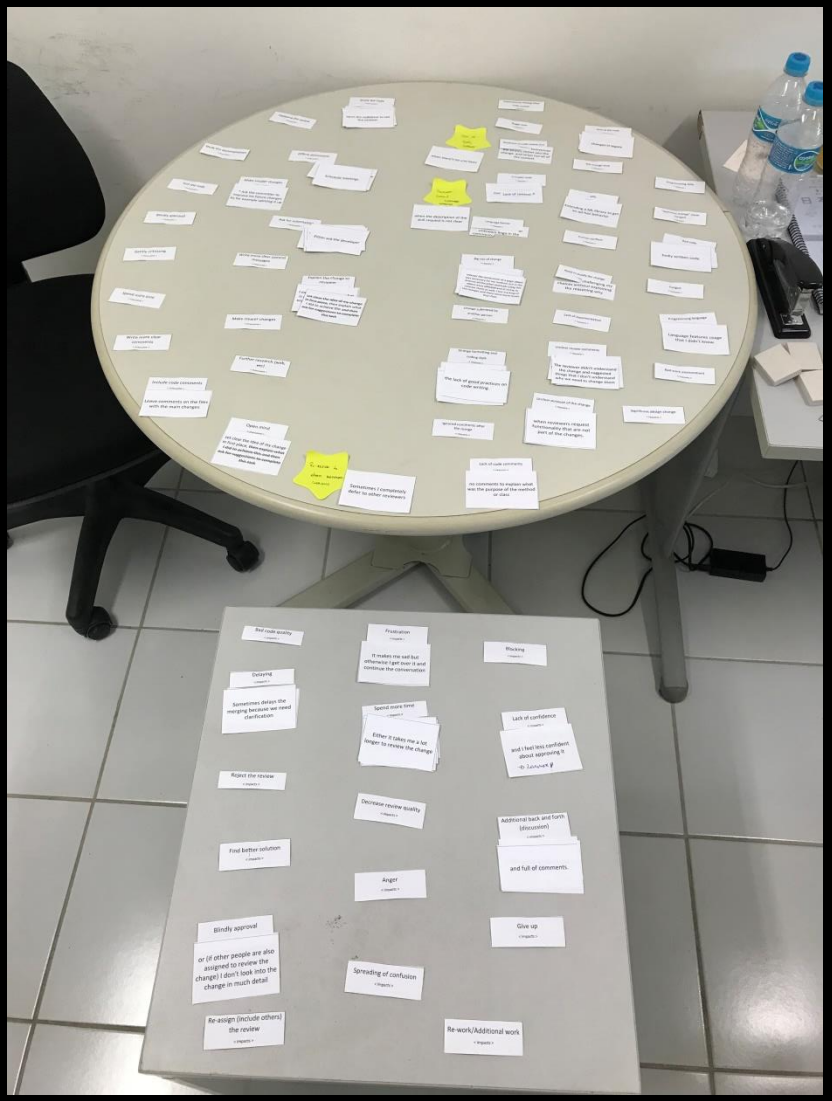
- ○ Yes
- ○ No

- Open survey:
  - Twitter
  - Facebook
- Responses: 13

Card Sorting - closed



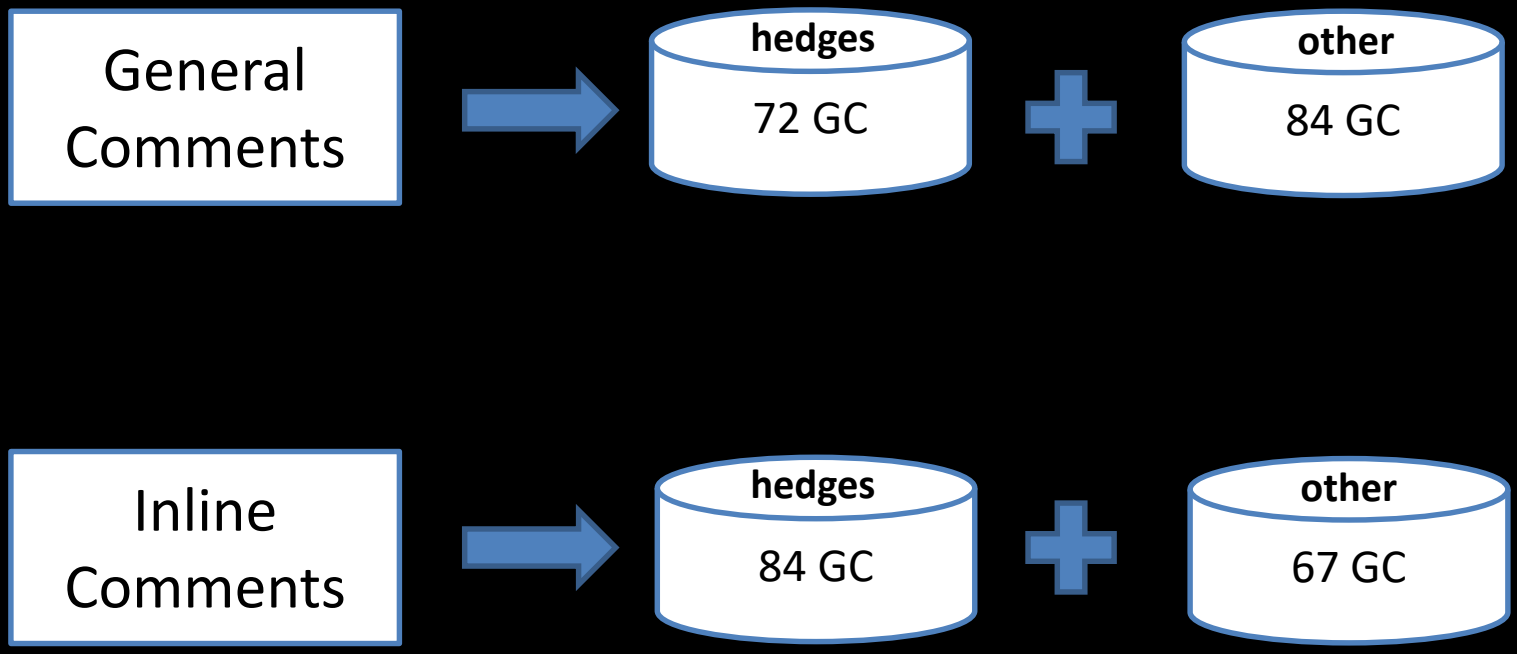
Problem: saturation!!!

1st + 2nd Survey Results

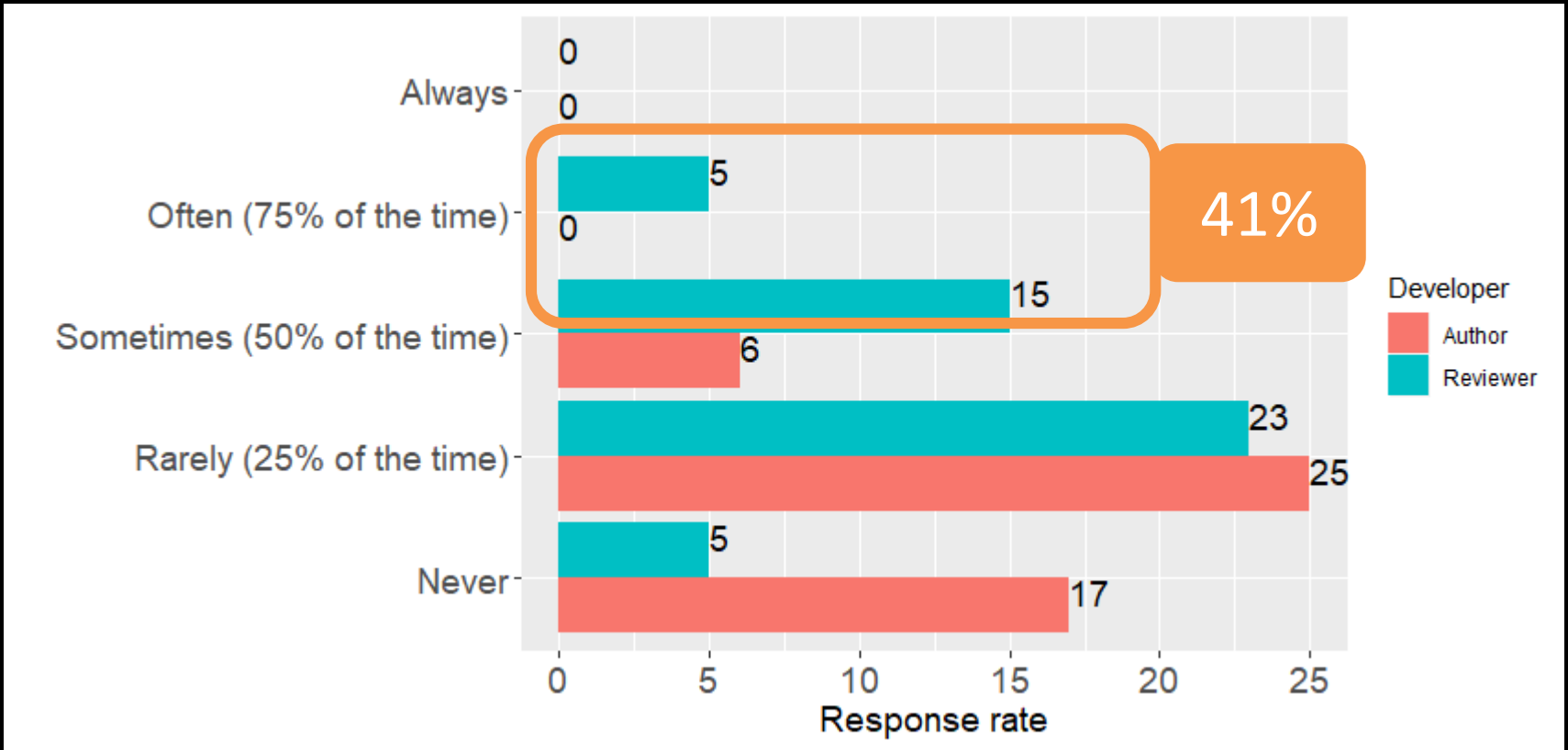
3rd Survey Results

No new topics!!!

Code Review Comments



Frequency of Confusion



Results

	Review Process	Increase of Review Time (subcategory of Review Process)	Artifact	Developer	Link Developer -> Artifact
Reason for Confusion	Unclear review comments		Lack of documentation	Fatigue	Lack of knowledge: programming language
	Unclear purpose of the change		Significant design change	Bad work environment	Lack of knowledge: programming skills
	Dependencies among other code reviews		Buggy change	Not enough time	Area of the code
	Weakness of code review tool		Complex change	Human conflicts	Lack of knowledge: APIs
	Language barrier		Big size of change	Explain and/or justify the change	
	Change submitted by another person		Strange formatting and coding style		
	Ignored comments after the merge		Bad change quality		
	"approved change" never merged				
Impacts of Confusion	Blindly approval	Blocking	Find better solution	Give up	
	Re-assign (include others) the review	Additional back and forth (discussion)	Re-work/Additional work	Anger	
	Spreading of confusion	Delaying	Bad change quality	Frustration	
	Decrease review quality	Spend more time		Lack of confidence	
	Reject the review				
Coping with Confusion	Spend more time		Make smaller changes	Offline discussions	Study the code
	Postpone the review		Write clearer commit messages	Ask for information	Study the documentation
	Blindly approval		Make clearer changes	Write clearer comments	Test the change
	Re-assign (include others) the review		Include code comments	Gently criticizing	Further research (web, etc)
				Open mind	
				Explain and/or justify the change	

Reasons for Confusion

Unfamiliar code vicinity

"No background for the part where I reviewed"

Big code change size

"Usually huge patches are confusing. "

Unclear review comments

"Other reviewers add comments that seem to be based on confusion."

Impacts of Confusion

Spend more time

"Such cases takes more time."

Anger

"It pissed me off"

Find better solution

"Sometimes I can encounter a better solution than my thought."

Coping Strategies

Ask for information

"sometimes I need simply to ask about the meaning."

Gently criticising

"Trying to be « a nice person. » Gently criticising the code."

Blindly approval

"assume the best, (of the change)"

2nd Study – Main Takeaways

- Confusion is present!
  - Survey: “developers said!”
  - Code review comments: “developers did!”

2nd Study – Main Takeaways

- Confusion is present!
  - Survey: “developers said!”
  - Code review comments: “developers did!”
- Code Review Conduct Guideline
  - What not to do!
  - How to deal with confusion!

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- Confusion is present!
  - Survey: “developers said!”
  - Code review comments: “developers did!”
- Code Review Conduct Guideline
  - What not to do!
  - How to deal with confusion!
- Automatic code review tools support

Communicative Intention of Questions

The first study of the communicative intentions of the developers participating in code reviews.

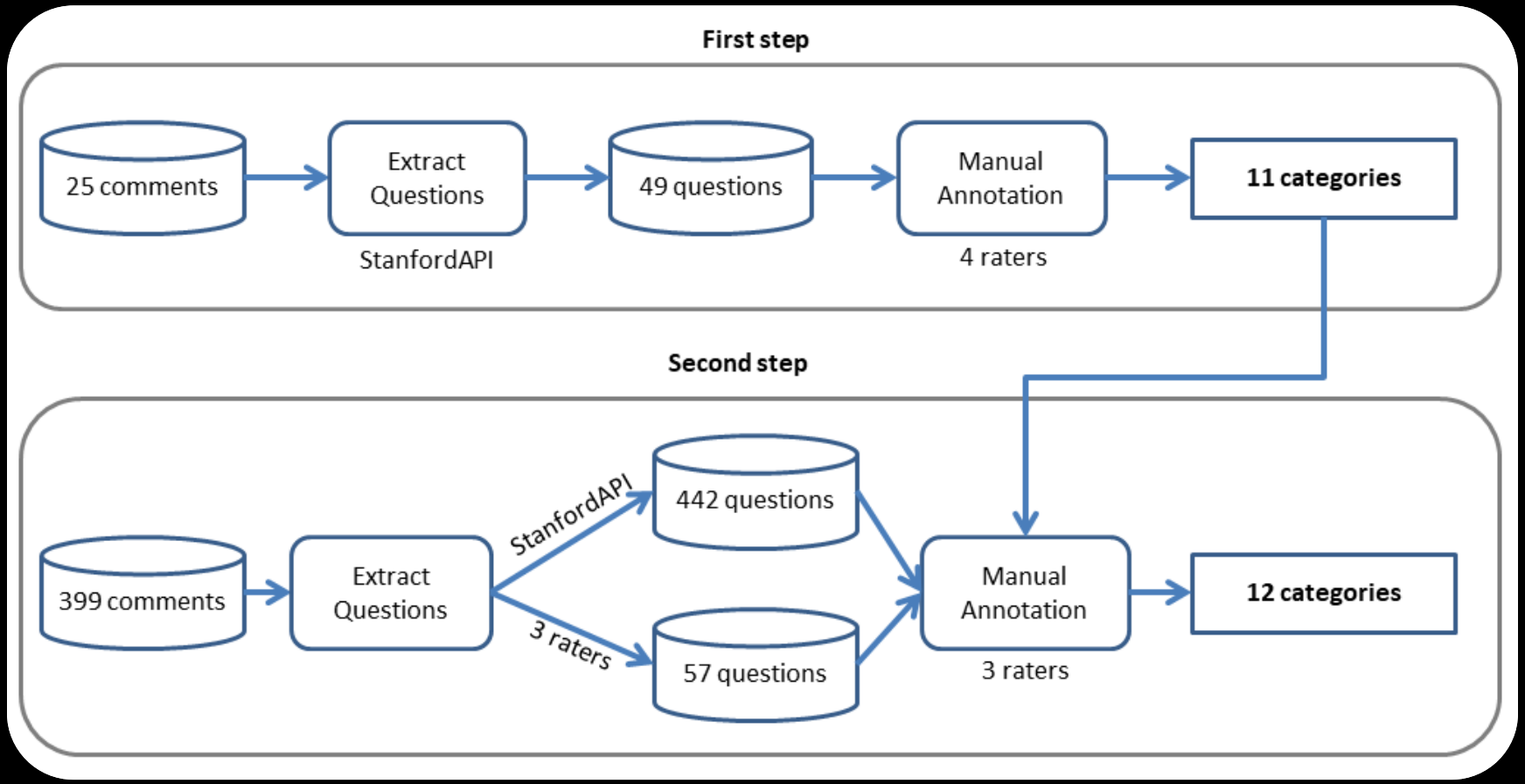

que pasa?!
nada!
???????
nada!
NADAAAAAAA!!!
Boludo!

What do you mean when you ask a question?

How frequent are questions in code reviews?

	General comments	Inline comments
With at lest one Question	10,965 (1,65%)	33,711 (14,50%)
Without any Questions	649,880 (98%)	198,760 (85%)
Total	660,845	232,471

Exploratory Case Study



Soliciting an action

Suggestion

"Maybe introduce an additional line between 'abc' and 'def'?"

Request for action

"Can you make these different?"

Information seeking

Information	“When can this be null?”
Confirmation	“Shouldn’t this just be a failure?”
Rationale	“Why is this included?”
Clarification	“What’s happening here?”
Opinion	“Which name do you suggest?”

Attitudes and Emotions

Criticism

"Do you really want to return the address of a local variable here?"

Anger

"wtf? you really want reflection here?"

Surprise

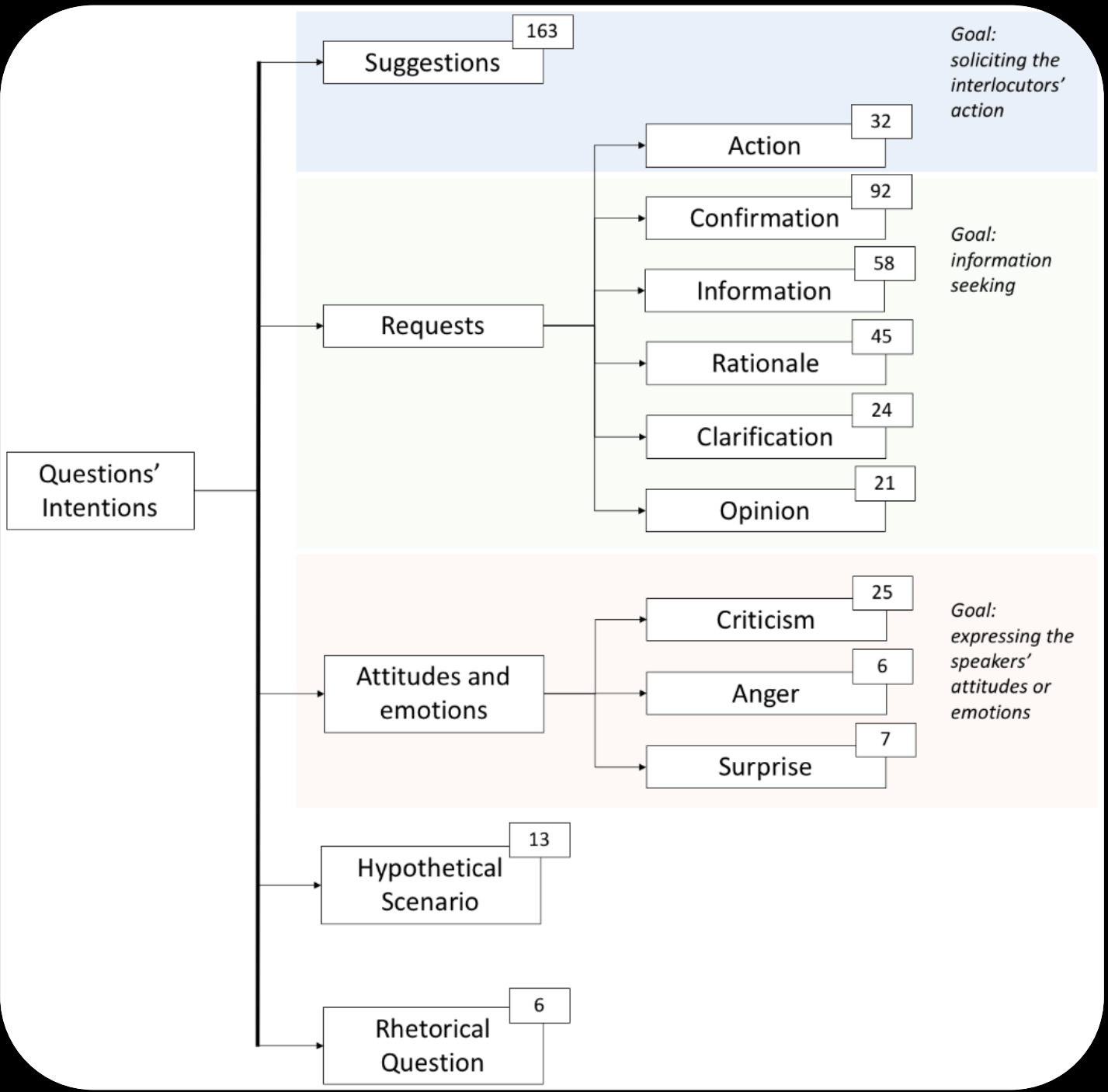
"Is this true? That seems mildly surprising"

Hypothetical scenarios

"What about if an already Jack server is running?"

Rhetorical questions

"Isn't the case that you illustrated (0.9ms being decremented as 0) applicable in both solutions? Yes"


Questions' Intentions
Suggestions
163
Goal: soliciting the interlocutors' action
40%
Requests
Action
32
Confirmation
92
Information
58
Rationale
45
Clarification
24
Opinion
21
Goal: information seeking
49%
Attitudes and emotions
Criticism
25
Anger
6
Surprise
7
Goal: expressing the speakers' attitudes or emotions
8%
Hypothetical Scenario
13
3%
Rhetorical Question
6
1%

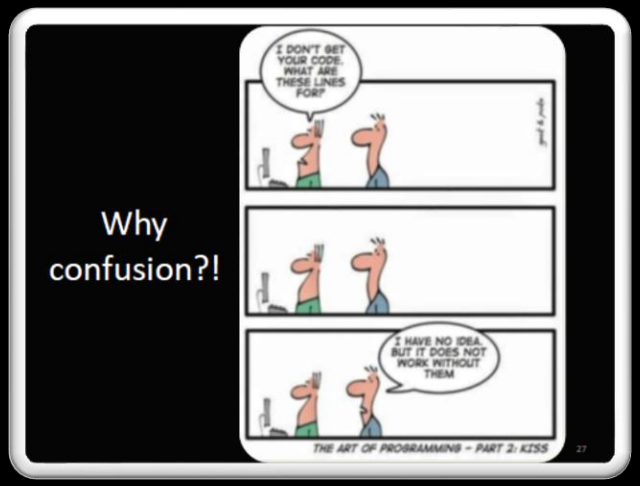
3rd Study – Main Takeaways

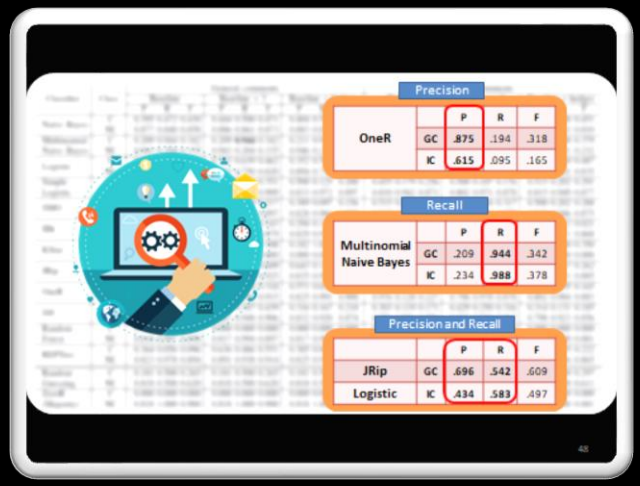
- Questions are more present in the IC than GC

3rd Study – Main Takeaways

- Questions are more present in the IC than GC
- Questions:
  - Not only information seeking
  - Suggestions
  - Attitude and emotions

Understanding Confusion in Code Reviews





Felipe Ebert – felipe.ebert@gmail.com