Code review best practices

xjm - DupalCamp New Jersey - 2023-03-17

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No photos please

I'm xjm
Drupal core release manager

- Core committer at **Agileana**

- Reviewing core patches since **2011**

- Committing core changes and providing releases since **2015**

- Member of the **Drupal Security Team**

- Previously:

  - **Views in Drupal Core** (2012-2013)

  - **Core Contribution Mentoring** (2011-2013)

drupal.org/u/xjm

@xjmdrupal

Building stronger teams

Why code review matters

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Peer code review builds stronger teams

Build **shared understanding** of your codebase

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Peer code review builds stronger teams

Foster **open, constructive communication**

Image credit:
Illek Petr

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Peer code review builds stronger teams

Sense of **pride and shared ownership** for projects

Image credit:
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Peer code review builds stronger teams

Mentor junior developers

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Peer code review builds stronger teams

Write better code **next time**

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Foster a supportive review culture

- Treat each other as **equals**.
- Start with **humility**.

Image credit:
Illek Petr

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Foster a supportive review culture

xjm
@xjmdrupal

Please don't auto-RTBC things when "all committer points of feedback are addressed". 🙂 I need your brains peer-reviewing that my feedback made sense in the first place. 👩‍🏫 Thanks for your patches and reviews!

3:08 AM · May 19, 2020

Image credit:
Illek Petr

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Foster a supportive review culture

Exercise **empathy.**

Image credit:

Illek Petr

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Foster a supportive review culture

- Ask **questions** and make **suggestions**.

- When you disagree, **encourage** others to explain their perspective.

Image credit: Illek Petr

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Structure of a constructive review

1. Start by **thanking them** for something they did well.

2. Provide **detailed comments** on lines that should be changed, with **references**.

3. Close with a summary and **actionable next steps** for the author(s).

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How our brains work

The psychology of code review

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Decision fatigue

After making **many decisions,** our ability to make additional decisions becomes worse

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Directed attention fatigue (DAF)

When we have to **focus on a task**, our brains have to **suppress** stimuli from **distractions.**

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Directed attention fatigue (DAF)

The **distraction suppression** mechanism becomes **fatigued** when overused.

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Distractions are an accessibility issue

DAF affects neurotypical people **temporarily**.

ADHD compounds the same stress mechanism.

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Research on how to catch bugs

Defect detection

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What is defect detection?

Of the **potential bugs** or **flaws** in a code change set, **how many are identified** by a given process?

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Early defect detection matters

- Low-impact bugs are **twice as costly** to fix in production.
- Critical bugs can be **100 times as costly** to fix in production.

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Defect detection rates

Formal code review is on average twice as effective as automated testing for defect detection.

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Defect detection rates

Formal code review is on average twice as effective as automated testing for defect detection.

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Regression tests:
25%
of defects identified

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Unit tests:
30%
of defects identified
(on average)

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Static analysis:

33%

of defects identified

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Integration tests:

35%

of defects identified

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Formal code review:

60%

of defects identified

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Large beta tests (> 1000 users):

75%

of defects identified

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Defect detection

Combining design reviews, code reviews, QA, and testing can increase defect detection rates to **over 90%**.

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Peer code reviewers are your **most cost-effective** resource, so **optimize** for them

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Research on effective code review

Improving defect detection

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Defects found per LOC reviewed

Good: More defects recognized during review

Bad: Few defects recognized during review
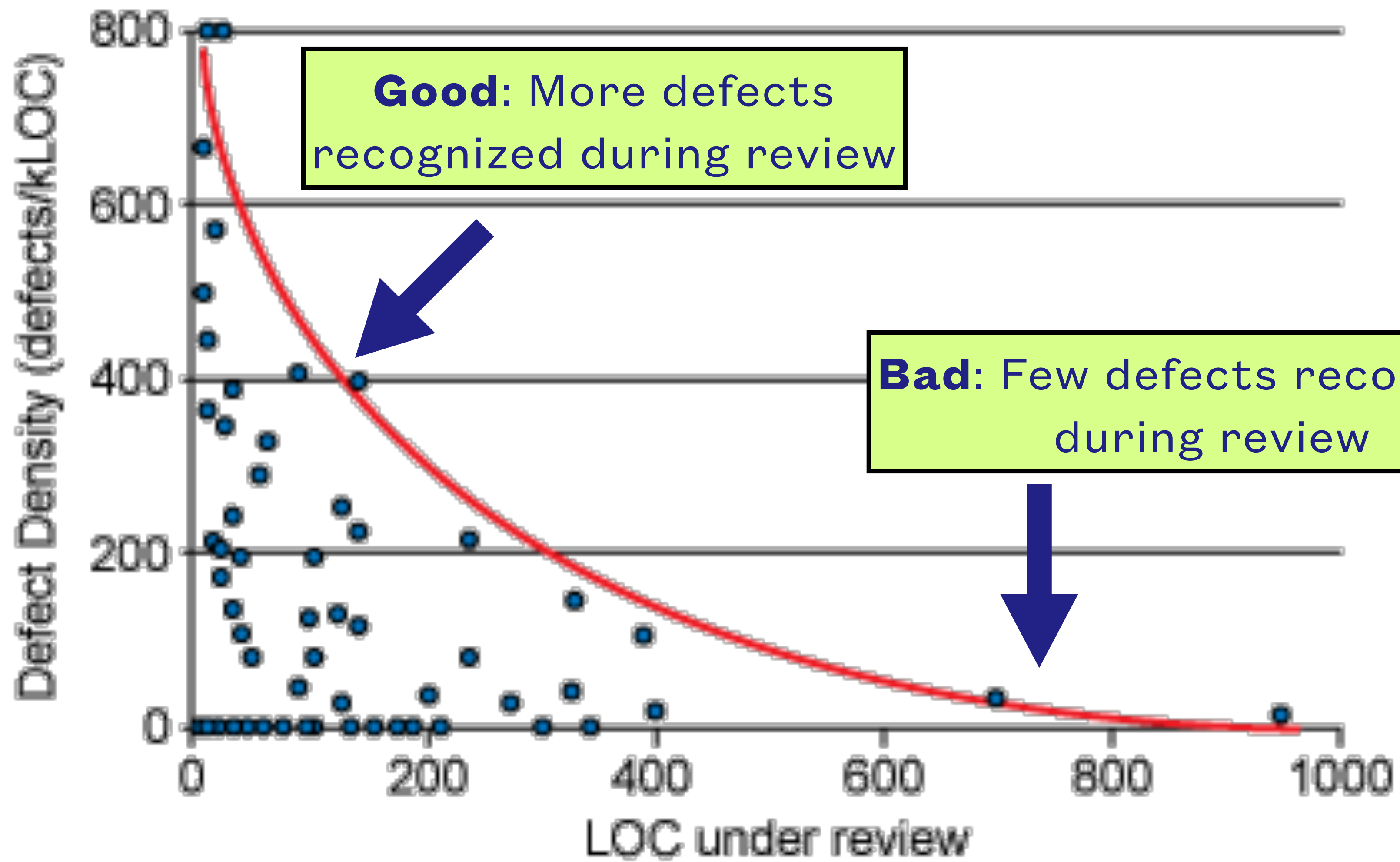
Why does this happen?

Reviewing too many LOC at once can cause **decision fatigue** and **DAF**.

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How do we fix it?

Fewer **lines** means fewer **decisions** and fewer **distractions.**

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How do we fix it?

Aim to review up to
200 lines of code
(added + removed) at a time.

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Good scope size: 114 LOC total

```
commit 829cd7ff156a3cefd5c7c41f5672b1bb069e0bbe
Author: bnjmnm <benm@umich.edu>
Date:   Wed Feb 22 16:05:29 2023 -0500

    Issue #3091478 by Tim Bozeman, lauriii, malcomio, EclipseGc, larowlan,
tim.plunkett, amateescu, dpi: Improve StringItem::generateSampleValue()


 .../Field/Plugin/Field/FieldType/StringItem.php     | 45 ++++++++++++++++++-
 .../EntityResource/WorkspaceJsonAnonTest.php        | 19 ++++++++++
 .../Drupal/Tests/Core/Field/StringItemTest.php      | 50 +++++++++++++++++++++++
 3 files changed, 113 insertions(+), 1 deletion(-)
```

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How do we fix it?

Do **not** review more than **400 lines of code** (added + removed) at a time.

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Bad scope size: 430 LOC total

```
.../tests/Drupal/KernelTests/Core/File/DirectoryTest.php    | 7 +++++--
.../Drupal/KernelTests/Core/File/ScanDirectoryTest.php      | 3 +--
.../Drupal/KernelTests/Core/Render/Element/TableTest.php    | 5 +++--
core/tests/Drupal/Tests/BrowserTestBase.php                 | 5 +++--
.../Drupal/Tests/Component/Datetime/DateTimePlusTest.php    | 7 ++++---
.../Component/DependencyInjection/ContainerTest.php         | 3 +--
.../Dumper/OptimizedPhpArrayDumperTest.php                  | 2 ++
.../Core/Cache/BackendChainImplementationUnitTest.php       | 6 ++---
.../Tests/Core/Config/Entity/ConfigEntityTypeTest.php       | 4 ++++
core/tests/Drupal/Tests/Core/Datetime/DateTest.php          | 6 +++---
.../Compiler/TaggedHandlersPassTest.php                     | 3 +--
.../Core/Entity/Sql/SqlContentEntityStorageTest.php         | 5 +++--
.../Tests/Core/Render/PlaceholderGeneratorTest.php          | 7 ++++---
.../Tests/Core/Render/RendererPlaceholdersTest.php          | 7 ++++---
.../tests/Drupal/Tests/Core/Routing/UrlGeneratorTest.php    | 6 ++---
94 files changed, 229 insertions(+), 201 deletions(-)
```

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Defects found vs. inspection rate
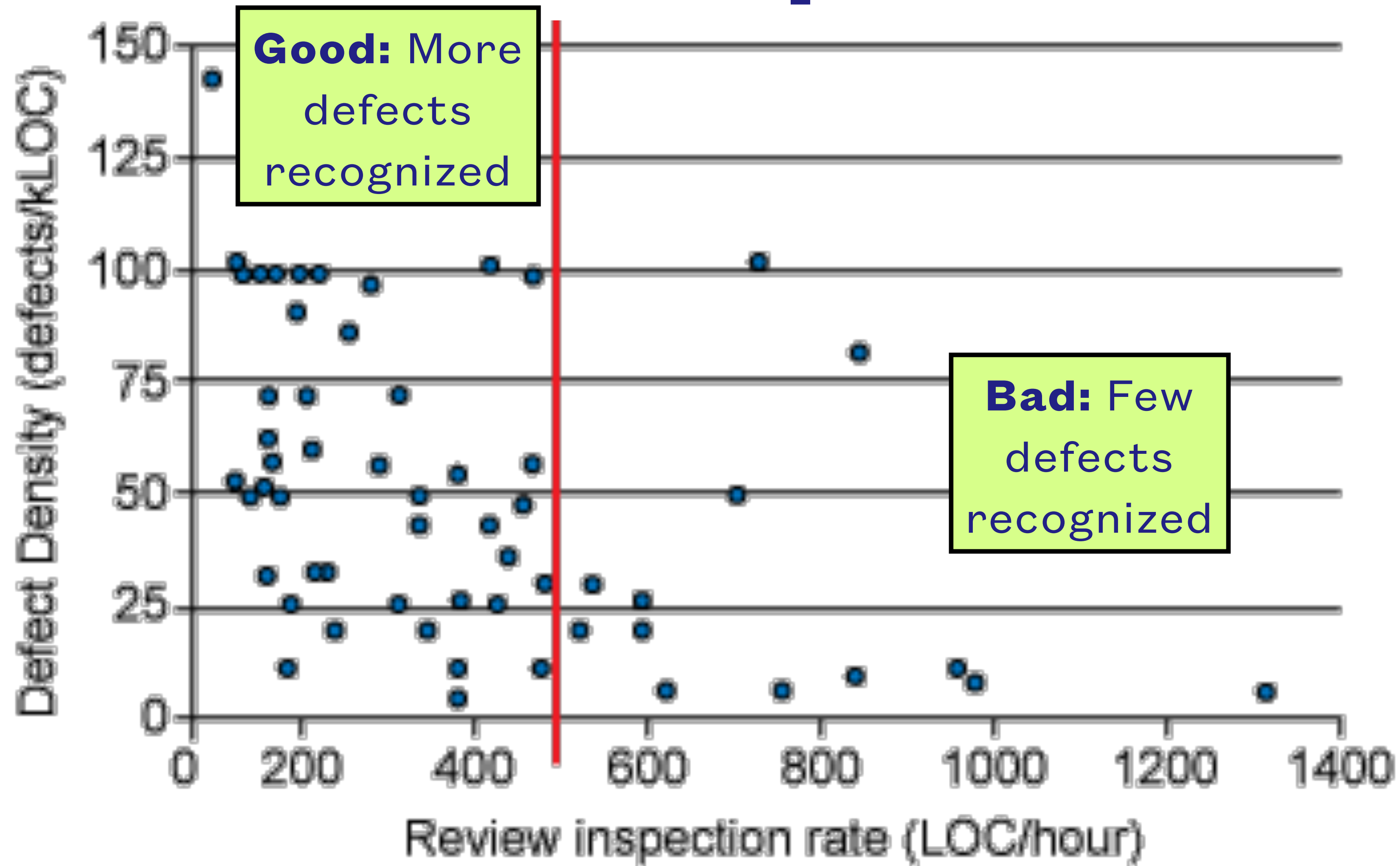
Why does this happen?

Same reasons:

too many **decisions**,

too many **distractions**.

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How do we fix it?

Review up to
500 lines of code
(added + removed) per hour.

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How do we fix it?

Do not spend more than **60 minutes** reviewing at a time.

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How do we fix it?

Take breaks!

Address other distractions between reviews.

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Handling nitpicks

That spinach in your teeth

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Code style and nitpicks
(That spinach in your teeth)

Code style errors are **distractions** that increase your **directed attention fatigue (DAF)**.

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Code style and nitpicks
(That spinach in your teeth)

Trivial decisions about fixing them also add to **decision fatigue**.

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Code style and nitpicks
(That spinach in your teeth)

Nitpicky reviews are **discouraging to code authors**.

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How do we fix it?
Automated tooling!

Instead of dozens of tiny nitpick decisions, you have one binary decision: **Did it pass automated coding standards checking?**

PHP 8.1 & MySQL 5.7 Custom Commands Failed

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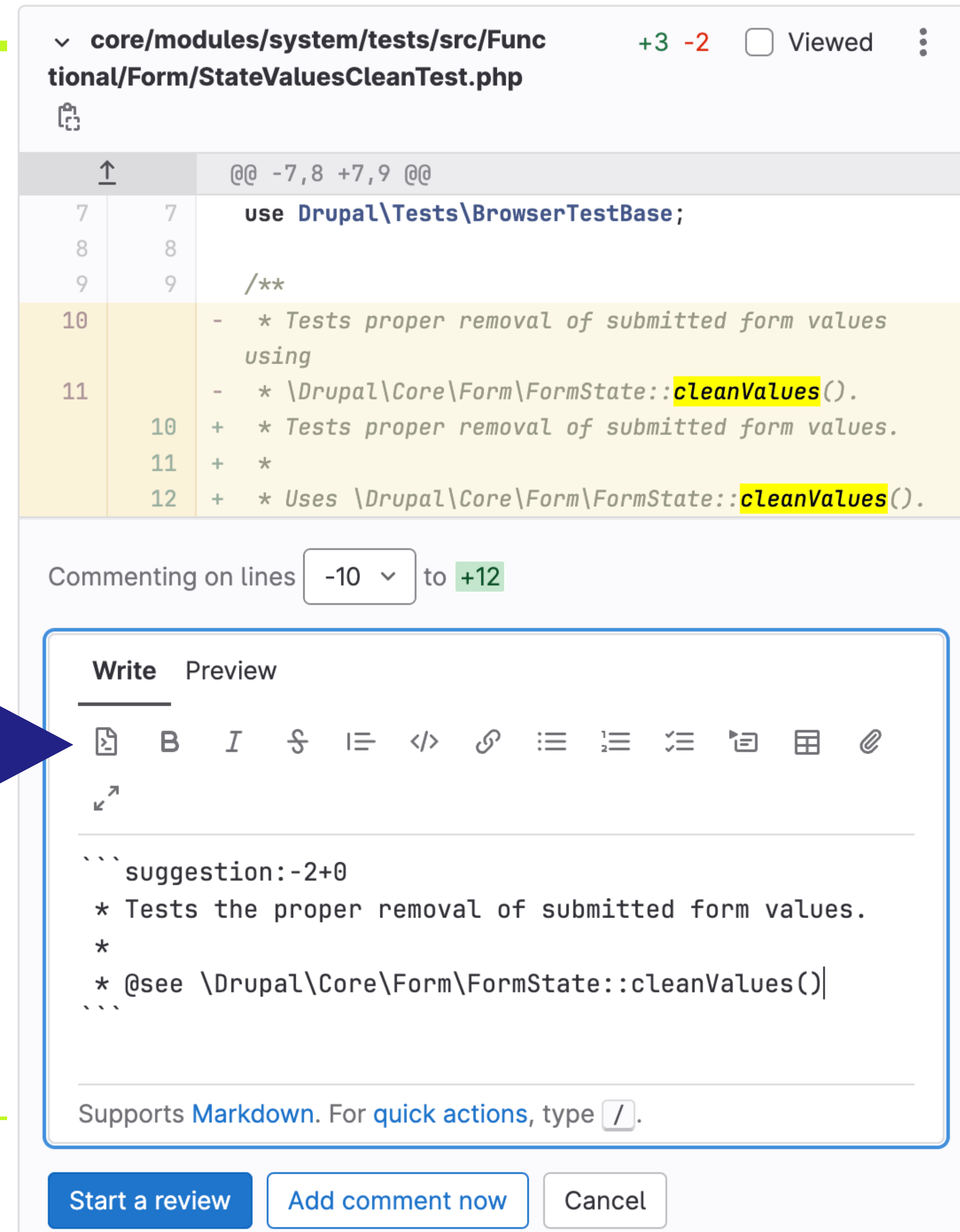
How do we fix it?
Automated tooling!

- PHPCS

- PHPStan

- CSpell

- ESLint

- Stylelint

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What about nitpicks that automated tooling can't catch?

Use the **GitLab suggestion feature!**

1. Highlight lines
2. Click this button
3. Edit the snippet

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What about nitpicks that automated tooling can't catch?

Use the **GitLab suggestion feature!**

The author can now add this change to the MR with a button click
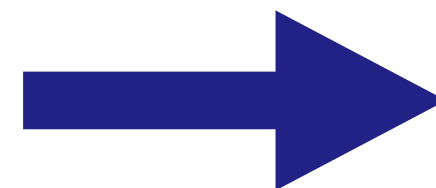
core/modules/system/tests/src/Functional/Form/StateValuesCleanTest.php

```
7    7     use Drupal\Tests\BrowserTestBase;
8    8
9    9     /**
10   -     * Tests proper removal of submitted form values using
11   -     * \Drupal\Core\Form\FormState::cleanValues().
     10   +     * Tests proper removal of submitted form values.
     11   +     *
     12   +     * Uses \Drupal\Core\Form\FormState::cleanValues().
```

Comment on lines +10 to +12

Jess @xjm · 2 weeks ago   Maintainer

Suggested change ⑦   Applied

```
10   -     * Tests proper removal of submitted form values.
11   -     *
12   -     * Uses \Drupal\Core\Form\FormState::cleanValues().
     10   +     * Tests the proper removal of submitted form values.
     11   +     *
     12   +     * @see \Drupal\Core\Form\FormState::cleanValues()
```

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Optimizing change sets for reviewers' brains

Issue scope guidelines

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Do:
Optimize for **readability** and **reviewability**

Do:
Keep change sets to **200-300 LOC or less**

Don't:
Leave the codebase in an **incomplete** or **broken** state

Do:
Include required **test coverage** and **documentation updates**

Don't:
Introduce **scope creep**

Don't:

Introduce **scope creep** (Even for repeated patterns)

Don't:

Introduce **scope creep**
(Even for repeated patterns)
(Even on the same line)

git diff --color-words

```
diff --git a/core/lib/Drupal/Component/PhpStorage/PhpStorageInterface.php b/core/lib/
Drupal/Component/PhpStorage/PhpStorageInterface.php
index fb9194c98a..7a370d252a 100644
@@ -54,3 +54,3 @@ public function save($name, $code);
   /**
    * Whether this is a writeablewritable storage.
    *
diff --git a/core/lib/Drupal/Core/StreamWrapper/StreamWrapperInterface.php b/core/lib/
Drupal/Core/StreamWrapper/StreamWrapperInterface.php
index a354785aff..38a7758d0a 100644
@@ -47,3 +47,3 @@ interface StreamWrapperInterface extends PhpStreamWrapperInterface {
   /**
    * Wrapper is writeablewritable.
    */
@@ -69,3 +69,3 @@ interface StreamWrapperInterface extends PhpStreamWrapperInterface {
   /**
    * Hidden, readable and writeablewritable using local files.
```

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git diff --color-words

```
diff --git a/core/lib/Drupal/Component/PhpStorage/PhpStorageInterface.php b/core/lib/
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@@ -54,3 +54,3 @@ public function save($name, $code);
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```

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git diff --color-words="."

```
diff --git a/core/lib/Drupal/Core/Asset/LibraryDiscoveryParser.php b/core/lib/Drupal/
Core/Asset/LibraryDiscoveryParser.php
index 702441d1fb..480ca23442 100644
@@ -210,3 +210,3 @@ public function buildByExtension($extension) {
                // Non core provided libraries can be in multiple locations.
                if (strposstr_starts_with($source, 'libraries/')=== 0) {
                    $path_to_source = $this->librariesDirectoryFileFinder-
>find(substr($source, 10));
diff --git a/core/lib/Drupal/Core/Cache/Context/CacheContextsPass.php b/core/lib/
Drupal/Core/Cache/Context/CacheContextsPass.php
index 2025fbbf61..579fc2a886 100644
@@ -20,3 +20,3 @@ public function process(ContainerBuilder $container) {
        foreach (array_keys($container->findTaggedServiceIds('cache.context')) as $id) {
            if (strpos!str_starts_with($id, 'cache_context.')!== 0) {
                throw new \InvalidArgumentException(sprintf('The service "%s" has an invalid
service ID: cache context service IDs must use the "cache_context." prefix. (The
suffix is the cache context ID developers may use.)', $id));
```

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git diff --color-words="."

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      foreach (array_keys($container->findTaggedServiceIds('cache.context')) as $id) {
        if (strpos!str_starts_with($id, 'cache_context.' !== 0 ) {
          throw new \InvalidArgumentException(sprintf('The service "%s" has an invalid
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```

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Advice from xjm

Specific recommendations

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Recommendation #1

Ask yourself if we should even be **making this change** in the first place. (Should it be done in contrib instead?)

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Recommendation #1

Ask yourself if we should even be **making this change** in the first place. (Should it be done in contrib instead?)

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Recommendation #2

Understand the **APIs** used in the change set.

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Recommendation #3

Check **patterns** and **scope** against the whole codebase (grep, grep, grep)

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Recommendation #4

Find out **why** it's this way in the first place!

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git log –L301,302:core/lib/Drupal/Core/TypedData/DataDefinition.php

```
-     * @todo: Remove in https://drupal.org/node/1928868.
+     * @todo: Remove in https://www.drupal.org/node/1928868.

e8c263c4a5956d278be8a61c836b2c6566416da6 Issue #2112239 by amateescu: Convert base
field and property definitions.

diff --git a/core/lib/Drupal/Core/TypedData/DataDefinition.php b/core/lib/Drupal/
Core/TypedData/DataDefinition.php
@@ -280,2 +305,2 @@
      * This is for BC support only.
-     * @todo: Remove once https://drupal.org/node/2112239 is in.
-     * @todo: Remove in https://drupal.org/node/1928868.

9bcaedec1558a70a0967581babc8ce429c40687b Issue #2047229 by fago, smiletrl, Berdir,
effulgentsia, amateescu: Make use of classes for entity field and data definitions.

diff --git a/core/lib/Drupal/Core/TypedData/DataDefinition.php b/core/lib/Drupal/
Core/TypedData/DataDefinition.php
@@ -0,0 +280,2 @@
+     * This is for BC support only.
+     * @todo: Remove once https://drupal.org/node/2112239 is in.
```

References

- [Best Practices for Code Review](#) (SmartBear)

- [Why code review beats testing: Evidence from decades of programming research](#) (Kevin Burke)

- [How to do a code review](#) (Google Engineering Practices Documentation)

- [Drupal core issue scope guidelines](#)

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