

The Smell of Stars – A small study on the correlation between GitHub popularity and code quality.

The stars of open source software projects on GitHub are often seen as an indicator of quality and maintainability. However, it remains unclear whether repositories with a high number of stars actually have better codes or whether their attractiveness is primarily determined by other factors such as functionality or marketing – a question to be addressed.

To assess code quality in an objective manner, two widely used metrics are considered: the number of *bad smells* per NCLOC (non-comment lines of code) and the *cognitive complexity* of a repository.¹ Bad smells refer to patterns in the code that indicate potential design flaws, making maintenance more difficult over time. Cognitive complexity,² on the other hand, measures how difficult it is for a human to understand a piece of code, reflecting its readability and maintainability. Both values can be extracted directly with *SonarQube*,³ a software tool for analyzing code quality. Using these measurements, the following research questions are investigated:

1. Does a high number of stars correlate with fewer code smells?
2. Does a high number of stars correlate with lower cognitive complexity?

Methodology

This research uses a quantitative approach to analyze a sufficiently large dataset of repositories. These will be further divided into PHP, JavaScript and Python projects to uncover possible differences between languages. A Python script, already partially written in preparation for this exposé, will crawl these projects from the GitHub API and then analyze the repositories with a locally running SonarQube instance. For this study, repositories with more than 10,000 stars are considered very popular and are counted among the projects with many stars. Finally, a statistical analysis will be performed to determine if there is a significant correlation between GitHub stars, the overall frequency of bad smells and cognitive complexity.

Hypothesis

This study assumes that repositories with a higher number of GitHub stars exhibit fewer bad smells and lower cognitive complexity. Accordingly, the following null and alternative hypotheses are formulated:

A₀: There is no significant correlation between stars and the number of bad smells.

A₁: Repositories with > 10.000 stars tend to have fewer code smells.

B₀: There is no significant correlation between stars and cognitive complexity.

B₁: Repositories with > 10.000 stars tend to have lower cognitive complexity.

¹Justus Bogner and Manuel Merkel. “To Type or Not to Type? A Systematic Comparison of the Software Quality of JavaScript and TypeScript Applications on GitHub”. In: *19th IEEE/ACM International Conference on Mining Software Repositories, MSR 2022, Pittsburgh, PA, USA, May 23-24, 2022*. Accessed: 04.02.2025. ACM, 2022, pp. 658–669.

²Himanshu Ganglani. *Clean Code: Cognitive Complexity by SonarQube*. Accessed: 04.02.2025. 2023. URL: <https://medium.com/@himanshuganglani>.

³*SonarQube Community Edition*. Accessed: 04.02.2025. 2025. URL: <https://www.sonarsource.com/open-source-editions/sonarqube-community-edition/>.