

Symbolic Capital in the Commons: A Gendered Analysis of Recognition and Economic Reward in Open Source Software

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Introduction

Recognition is a form of currency in open-source software (OSS) communities. Contributors who receive visible forms of acknowledgment—such as GitHub “stars,” project badges, shout-outs in release notes, or top-contributor mentions—often enjoy reputational benefits that enhance their visibility and credibility. These recognition systems, however, may not be equally distributed. Drawing from Pierre Bourdieu’s theory of *symbolic capital* and feminist theories of digital labor, this study asks whether visible forms of recognition in OSS function as gendered gatekeepers to material outcomes such as sponsorship income and bounty success.

In the current OSS ecosystem, economic support (e.g., GitHub Sponsors, OpenCollective) is tightly coupled to reputation signals: recognized contributors attract more donors. Yet, recognition itself may be biased by social norms, network effects, or visibility heuristics that favor men. This research systematically examines the relationship between symbolic capital and financial reward, asking: (1) Are public recognition markers (e.g., badges, acknowledgments, repository highlights) distributed unequally by gender? (2) Does symbolic recognition mediate the relationship between gender and economic outcomes? (3) How do language and discourse surrounding recognition encode implicit gender biases?

This study integrates computational text and image analysis with econometric modeling to investigate how recognition operates as a socio-technical mediator of inequality in open collaboration. By operationalizing symbolic capital within OSS data infrastructures, it seeks to empirically connect gender, visibility, and economic reward.

Methods

This research employs a mixed-methods design that combines large-scale data scraping, content classification, and statistical modeling with interpretive linguistic analysis.

Data Collection.

We constructed a dataset of 400 high-activity open-source repositories across diverse technical domains (machine learning, civic tech, developer tools, and web frameworks). Using the GitHub REST and GraphQL APIs, we collected contributor-level metadata including stars, forks, repository ownership, follower counts, and commit histories. Additionally, we scraped profile pages, README files, contribution graphs, and visible badges (e.g., “Top Contributor,” “Maintainer,” “Security Champion,” “First-Time Contributor”).

Text data were collected from project release notes, contributor lists, and issue acknowledgments. For example, release notes often contain lines such as “Thanks to [username] for fixing X!” or “Special shout-out to [username] for testing!” These acknowledgments represent informal recognition that contributes to community reputation. We captured both formal (badges, titles) and informal (mentions, thank-yous) recognition types.

Quantifying Symbolic Capital.

We operationalized symbolic capital through a composite **Symbolic Recognition Index (SRI)**. The SRI aggregates recognition signals along four dimensions:

1. **Frequency** (how often a contributor is recognized publicly),
2. **Visibility** (whether the recognition occurs in high-profile spaces, such as project READMEs or organization pages),
3. **Diversity** (number of distinct recognition types received), and
4. **Recency** (time elapsed since last recognition).

Each dimension was normalized to a 0–1 scale, and the composite index was validated using factor analysis and expert labeling ($n = 10$ maintainers). To capture visual symbols (e.g., profile badges, emojis), we applied computer vision analysis and OCR (Optical Character Recognition) using Tesseract and OpenCV to detect and parse badge text.

Gender Inference.

We employed a high-confidence probabilistic gender inference pipeline similar to that used in prior IC2S2 studies: combining Genderize.io, Wikidata name-gender pairs, and

pronoun references from linked social accounts. Contributors with confidence below 0.8 were excluded. The final analytic sample included approximately 2,700 contributors (650 women, 2,050 men).

Modeling Approach.

To analyze the relationship between gender, symbolic capital, and sponsorship income, we employed a **mediation modeling framework**. Sponsorship earnings (from GitHub Sponsors and OpenCollective) served as the dependent variable. Gender was the independent variable, SRI was the mediator, and control variables included project visibility, contributor tenure, follower count, and commit volume.

We estimated three models:

- **Model 1:** OLS regression of sponsorship on gender (baseline inequality).
- **Model 2:** Regression of SRI on gender (testing recognition disparity).
- **Model 3:** Regression of sponsorship on both gender and SRI (testing mediation).

We further applied the **Baron–Kenny mediation test** and **bootstrapped indirect effects** to quantify the proportion of the gender pay gap explained by recognition disparity. To examine language bias, we analyzed 20,000 acknowledgment sentences using sentiment analysis (RoBERTa-based tone classifier) and stereotype detection lexicons (e.g., “supportive,” “helpful,” “brilliant,” “genius”) to identify linguistic asymmetries in how contributors are praised.

All data processing was conducted in Python using the Pandas, Statsmodels, and Hugging Face libraries. Reproducible notebooks and anonymized datasets will be shared in an open repository.

Potential Impact

This study makes both empirical and theoretical contributions to understanding the reproduction of inequality in open collaboration. Empirically, it demonstrates how symbolic recognition—often assumed to be merit-based—is unevenly distributed and has measurable economic consequences. Our mediation analysis provides evidence that symbolic capital partially explains the gender sponsorship gap in OSS: men are recognized more frequently and more visibly, and this recognition directly influences their likelihood of receiving financial support.

Theoretically, the study brings Bourdieu's concept of symbolic capital into computational social science, operationalizing it through traceable digital artifacts. It also integrates feminist critiques of visibility, highlighting how the valorization of "technical genius" over "community support" reproduces historical gender hierarchies.

Practically, the findings can inform OSS platform policies and community governance practices. Recognition systems—such as badge awarding algorithms, contributor listings, and project websites—can be redesigned to reflect diverse forms of contribution. Platforms might rotate visibility to ensure equitable exposure or introduce structured acknowledgment fields to make community-oriented labor more visible.

By combining data science with critical theory, this research reframes recognition as a site of economic inequality in digital labor economies and offers a roadmap for designing fairer, more inclusive systems of acknowledgment in open-source ecosystems.