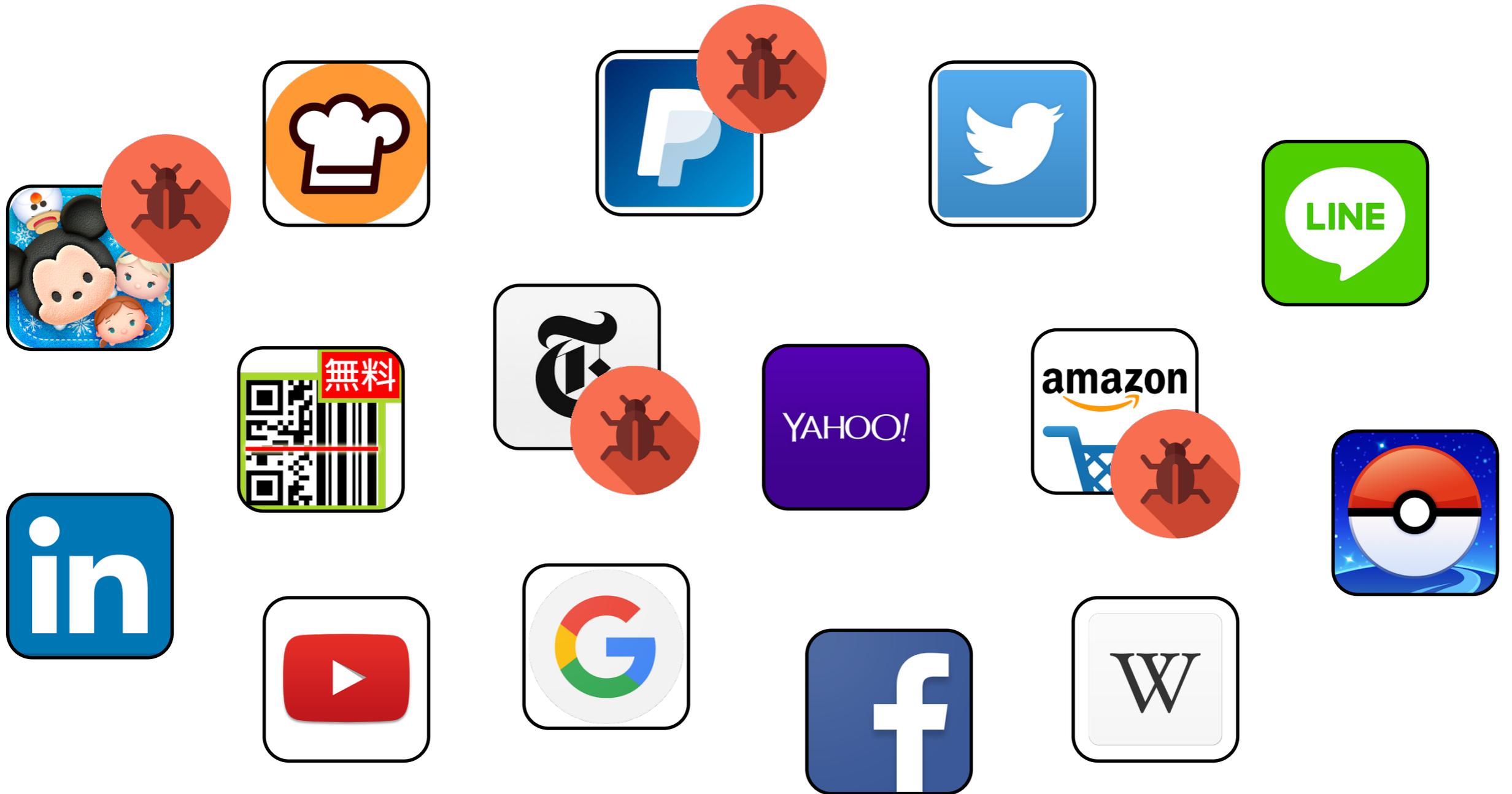


An Empirical Investigation into the Reproduction of Bug Reports for Android Apps

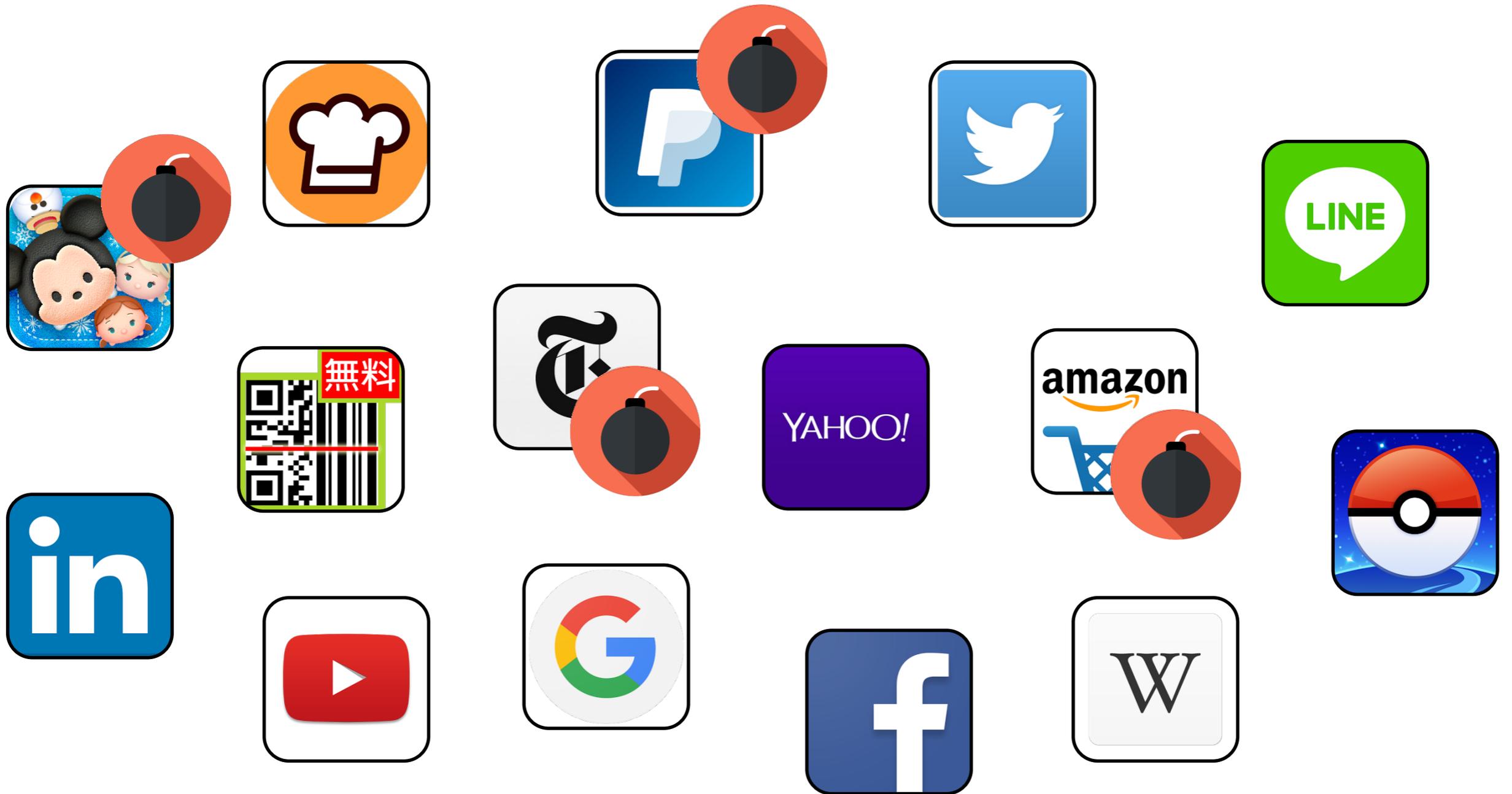
*Jack Johnson**, *Junayed Mahmud⁺*, *Tyler Wendland**, *Kevin Moran⁺*, *Julia Rubin**, *Mattia Fazzini**



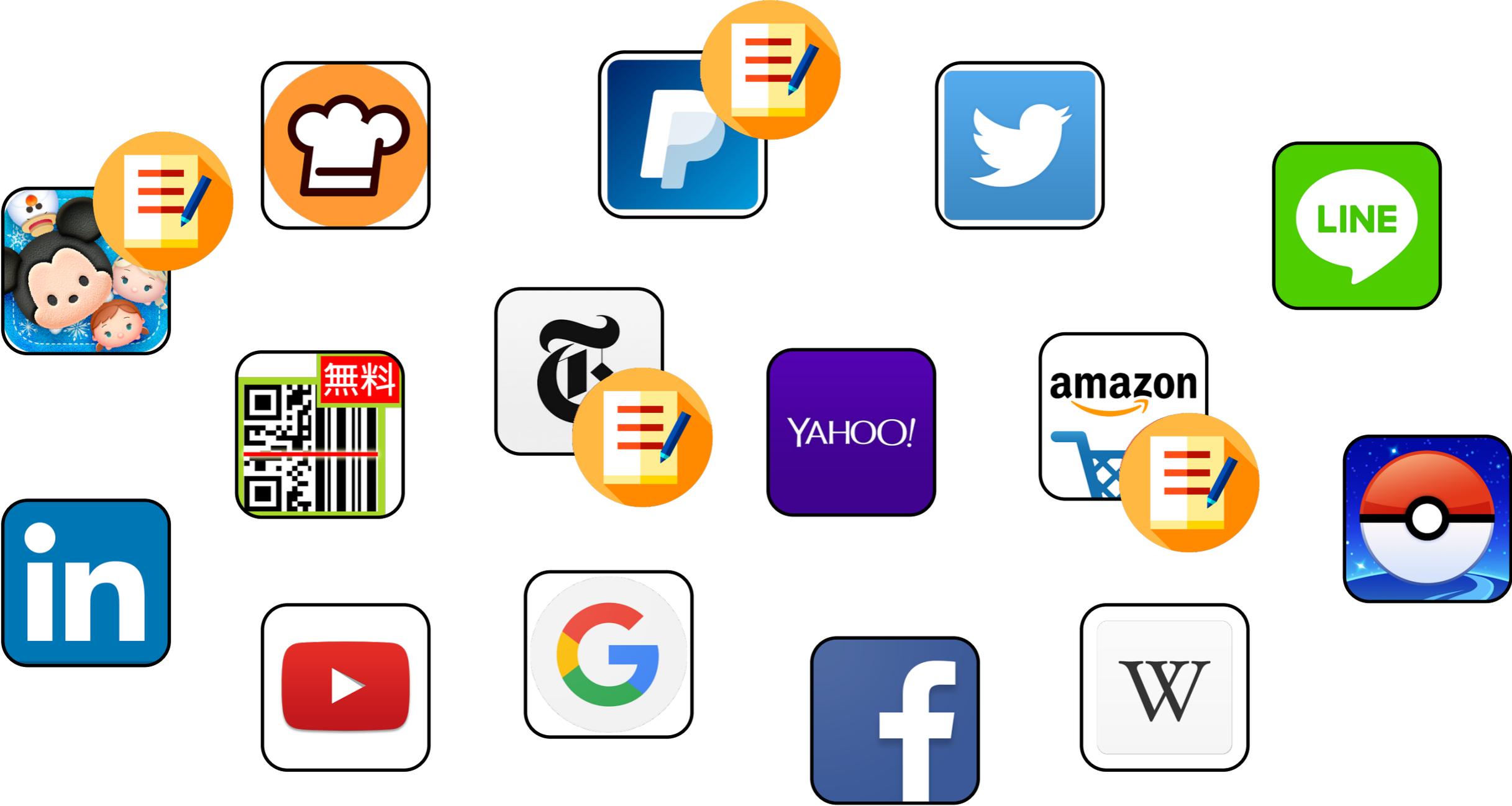
Latent Bugs



Failures



Bug Reports



Bug Reproduction



Content of Bug Reports

Bug Report

Bug Report

Title:
Bug: Long pressing the amount input brings up QWERTY keyboard

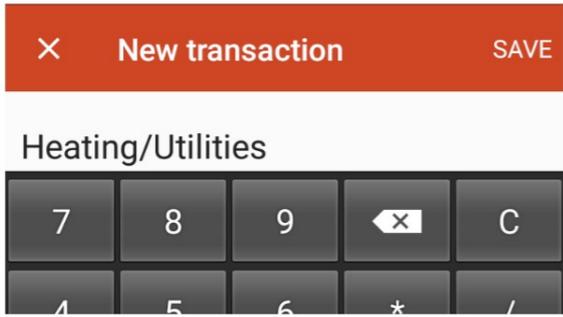
Content:

Software specifications:
GnuCash Android version: 2.2.0
System Android version: 6.0

Steps to reproduce the behaviour:

1. Navigate to Transactions screen
2. Tap the Add button
3. Enter Description (optional)
4. Focus the Amount input
5. Long press to bring up the context menu

Actual behaviour:



The screenshot shows a dialog box titled 'New transaction' with a red header bar containing a close button (X), the title 'New transaction', and a 'SAVE' button. Below the header, the text 'Heating/Utilities' is visible. A numeric keypad is overlaid on the screen, with the number '7' highlighted, indicating that the keyboard is active over the amount input field.

Content

Environment

Steps To Reproduce

Observed Behavior

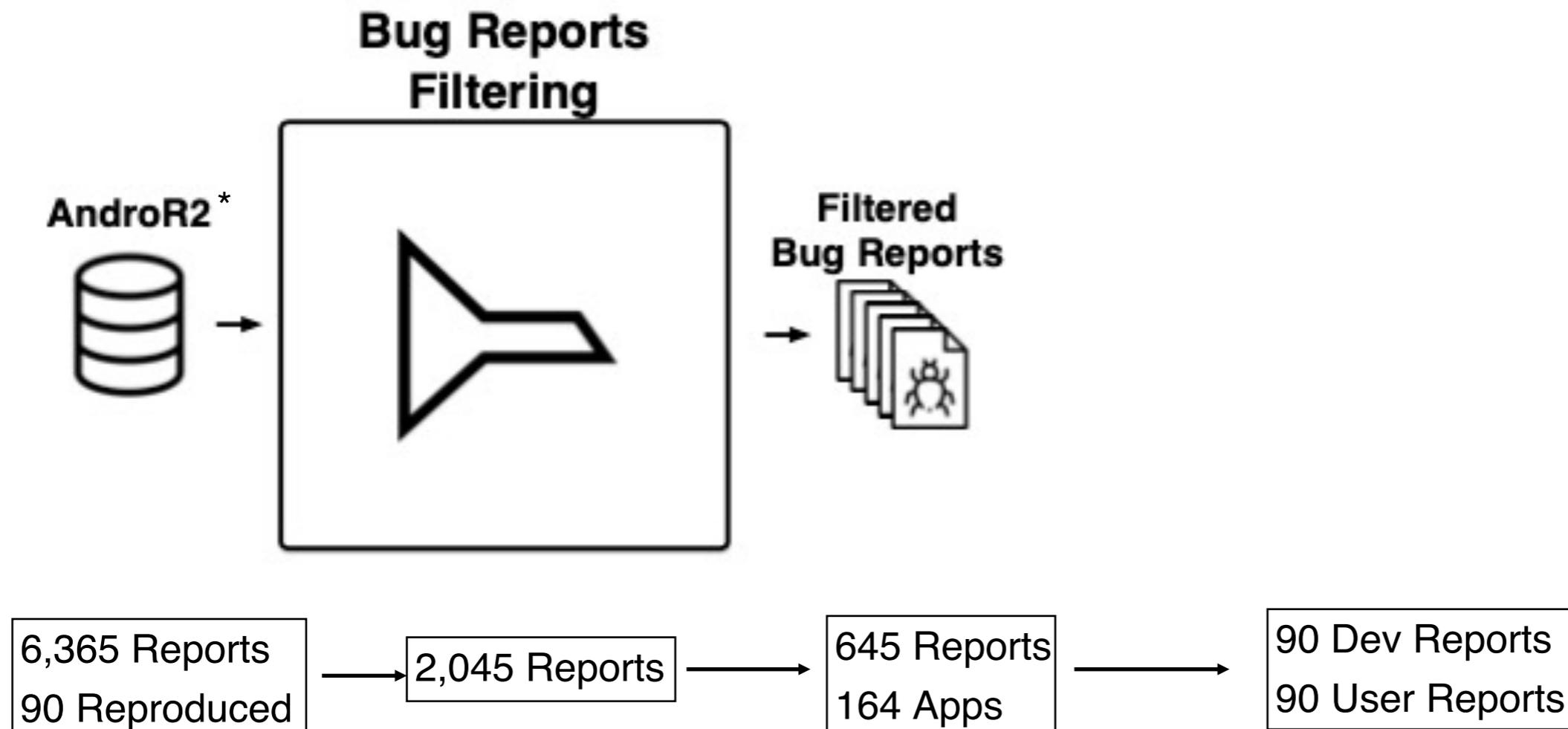
Study Overview

Our goal is to gain insight into the process of bug report reproduction

RQ1	What are the failure types associated with reproducible bug reports?
RQ2	What information modalities are used to report the information contained in reproducible bug reports?
RQ3	Do reproducible bug reports have missing information?
RQ4	Do discussion threads of reproducible bug reports contain helpful information for reproducing the reports?
RQ5	How specific is the information reported in reproducible bug reports?

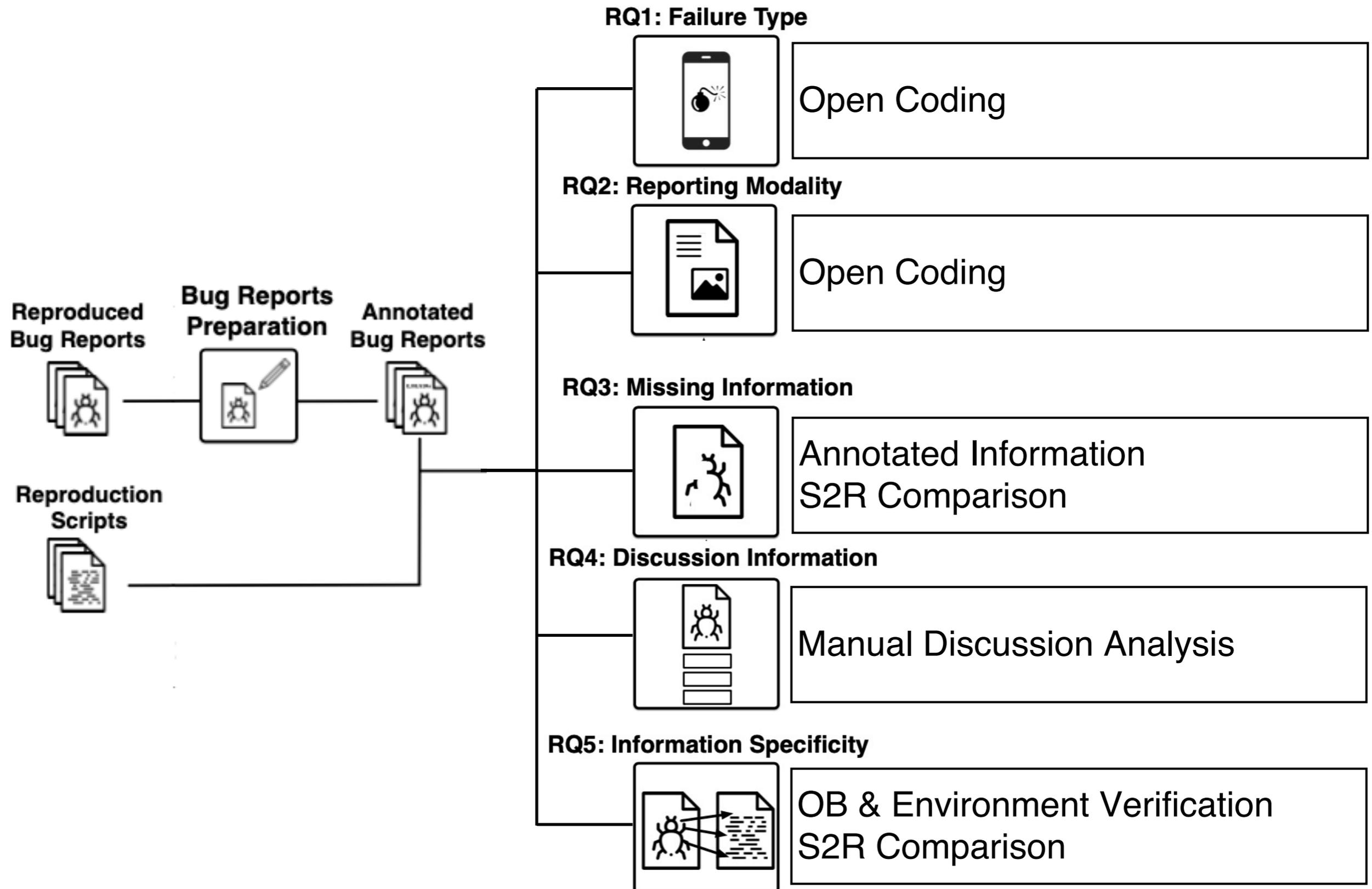
Dataset Creation

Dataset Creation



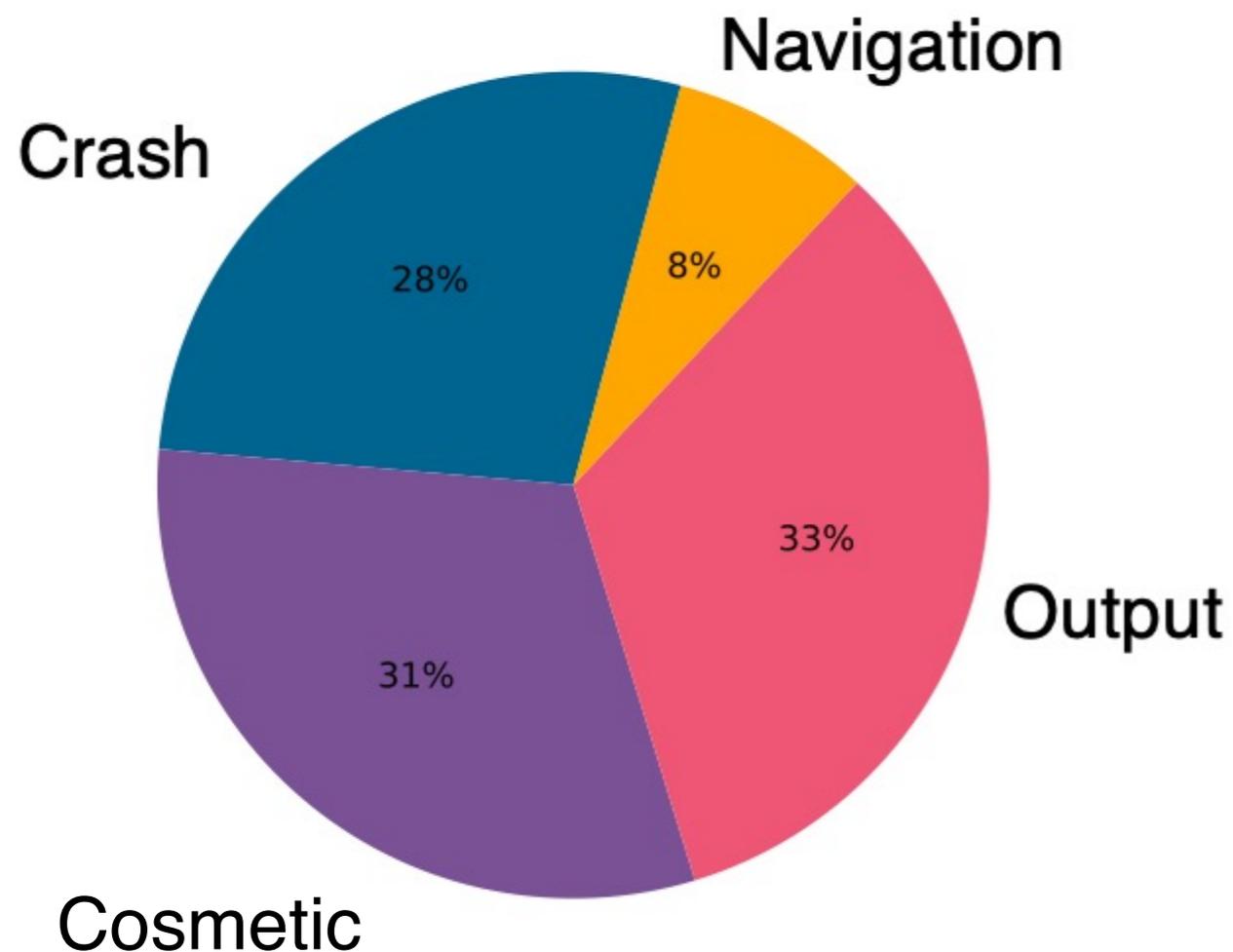
* T.Wendland,J.Sun,J.Mahmud,S.M.H.Mansur,S.Huang,K.Moran, J. Rubin, and M. Fazzini, "Andror2: A dataset of manually-reproduced bug reports for android apps," *2021 IEEE/ACM18th International Conference on Mining Software Repositories (MSR)*

Bug Report Analysis

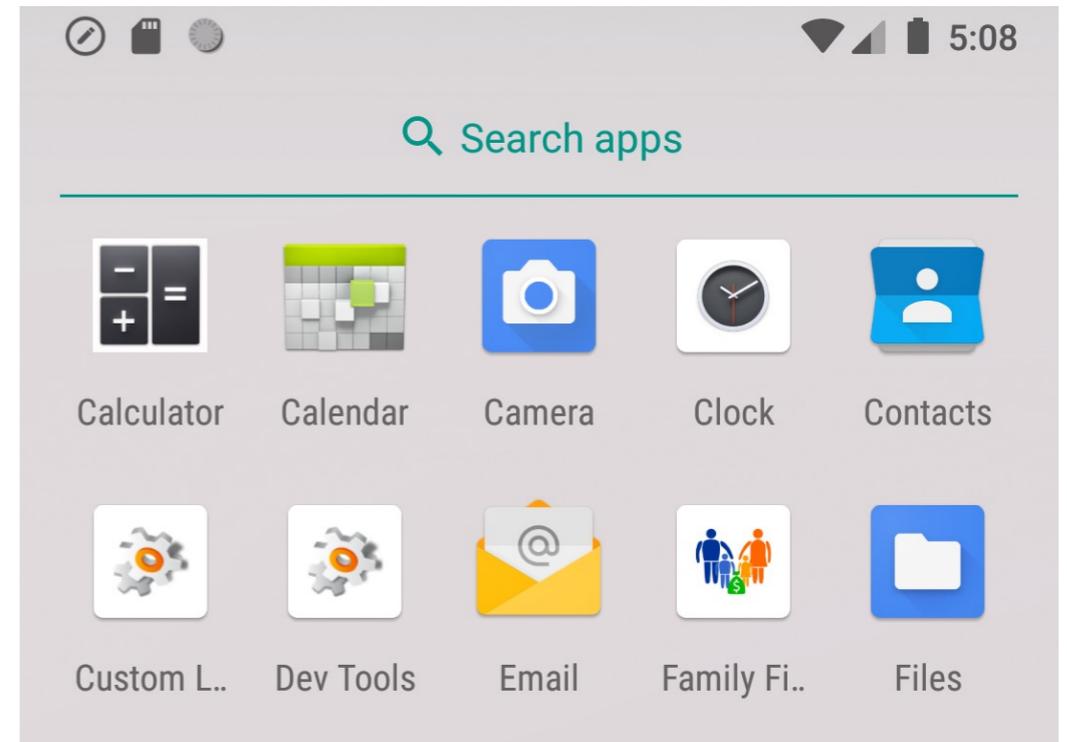


RQ1 Results

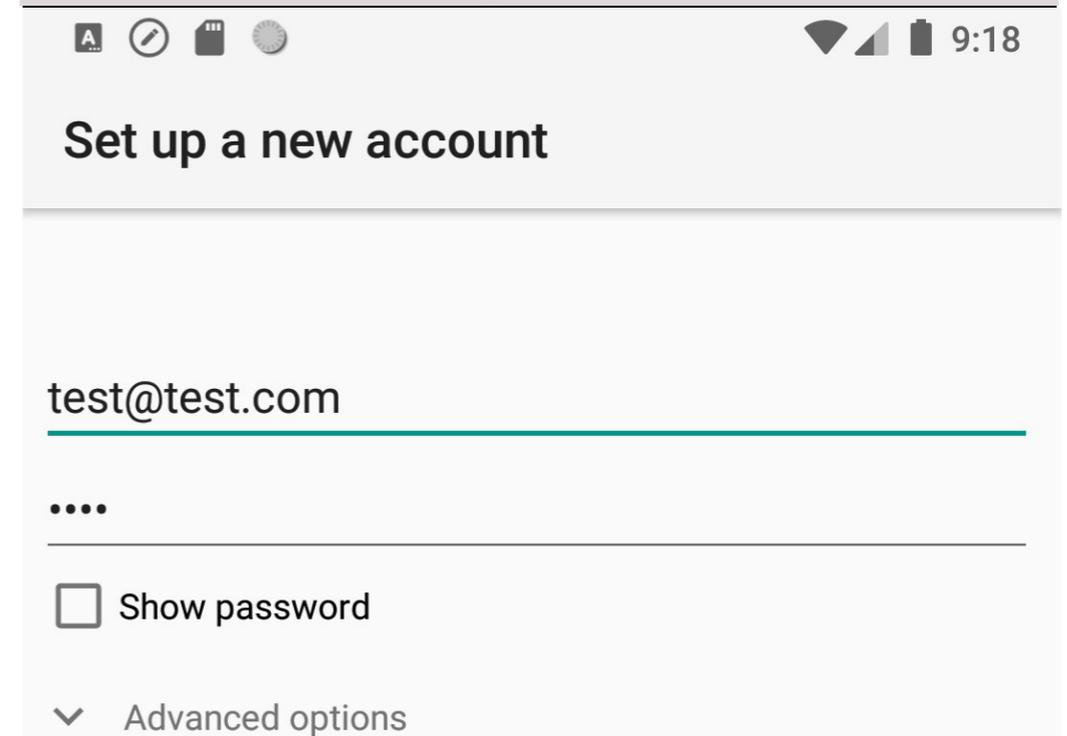
What are the failure types associated with reproducible bug reports?



Bug

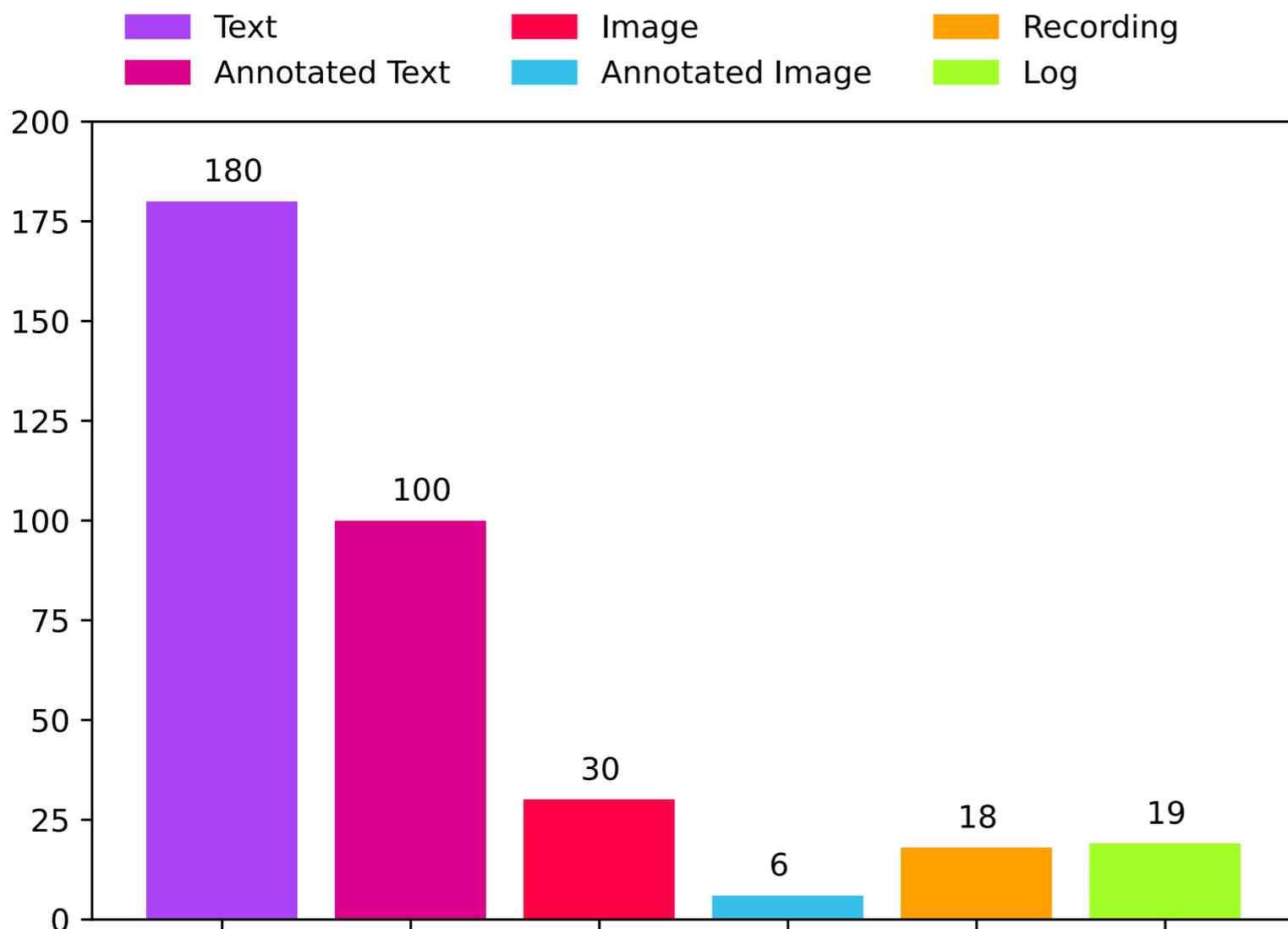


Fix



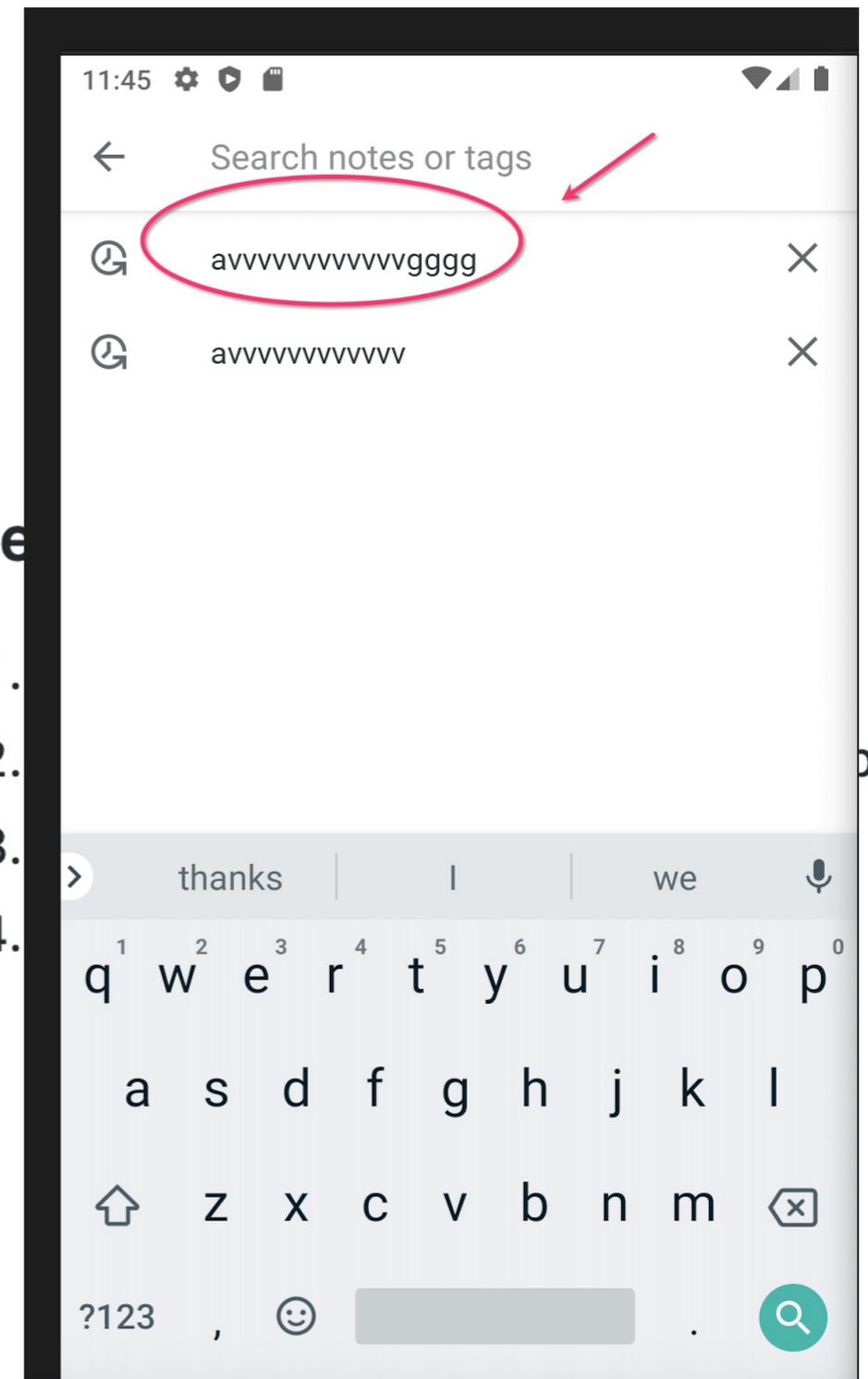
RQ2 Results

What information modalities are used to report the information contained in reproducible bug reports?



Step

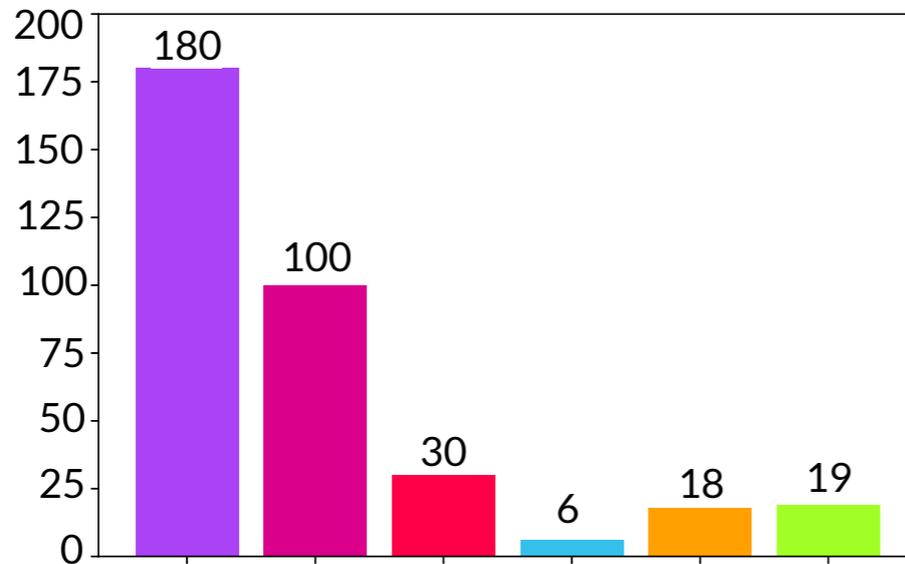
- 1.
- 2.
- 3.
- 4.



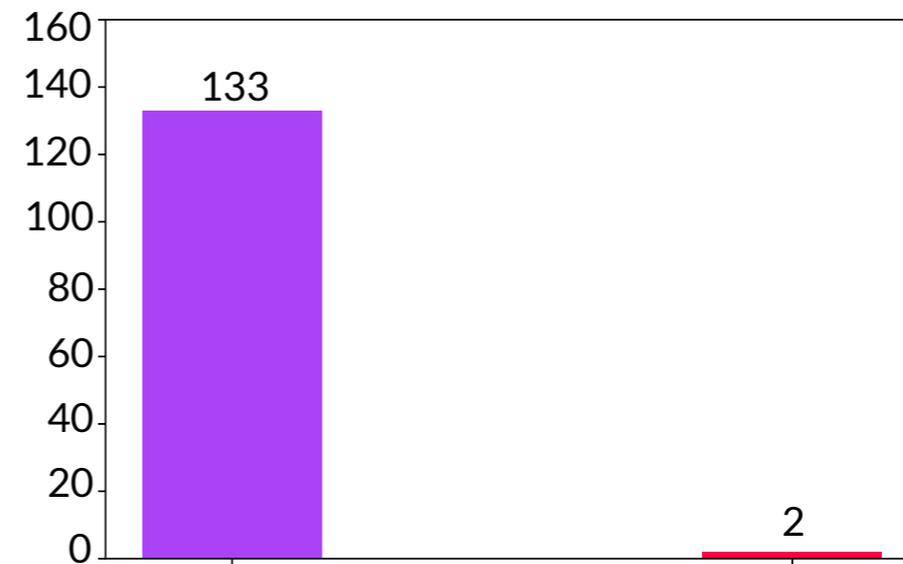
RQ2 Results

What information modalities are used to report the information contained in reproducible bug reports?

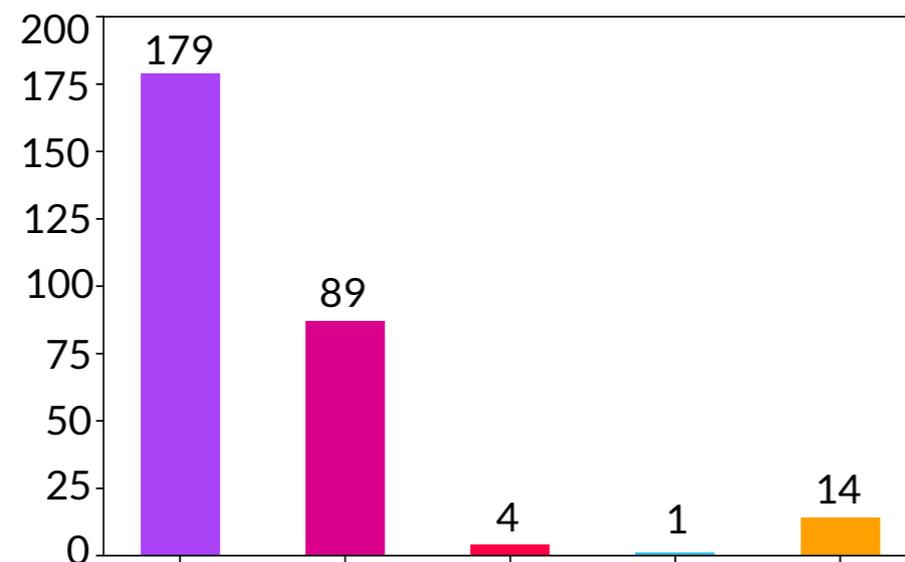
Text Annotated Text Image Annotated Image Recording Log



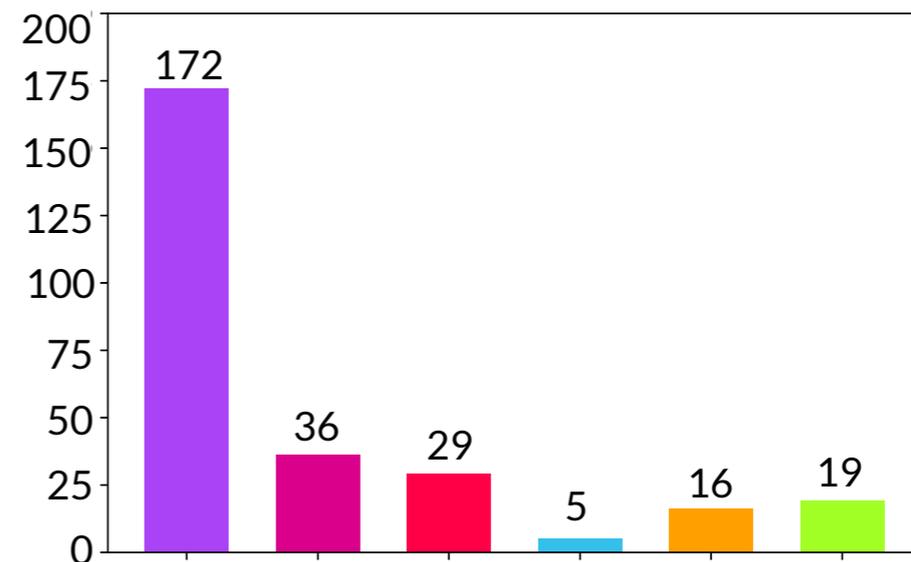
a) Modalities for bug reports.



b) Modalities for environment.



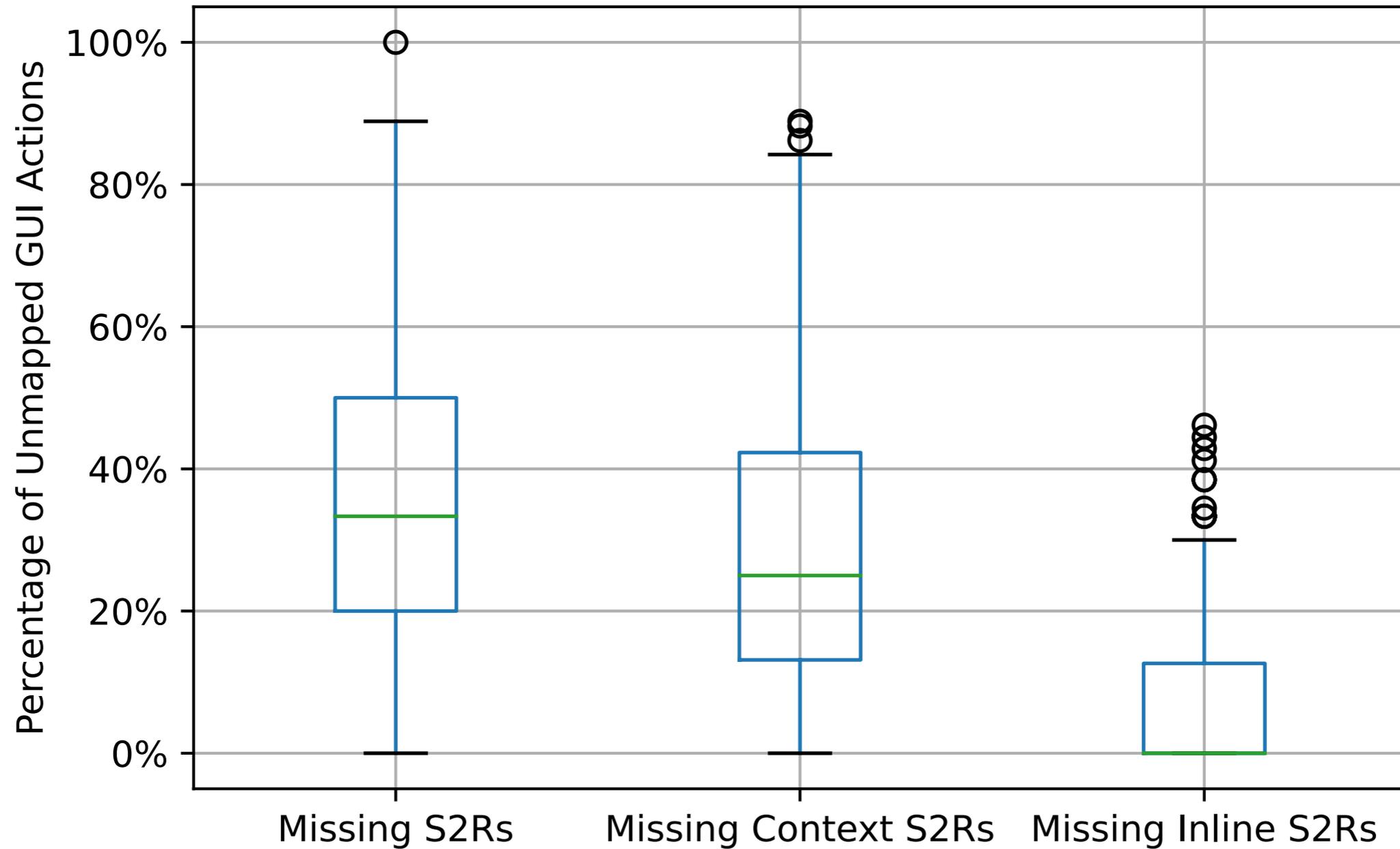
c) Modalities for S2Rs.



d) Modalities for OB.

RQ3 Results

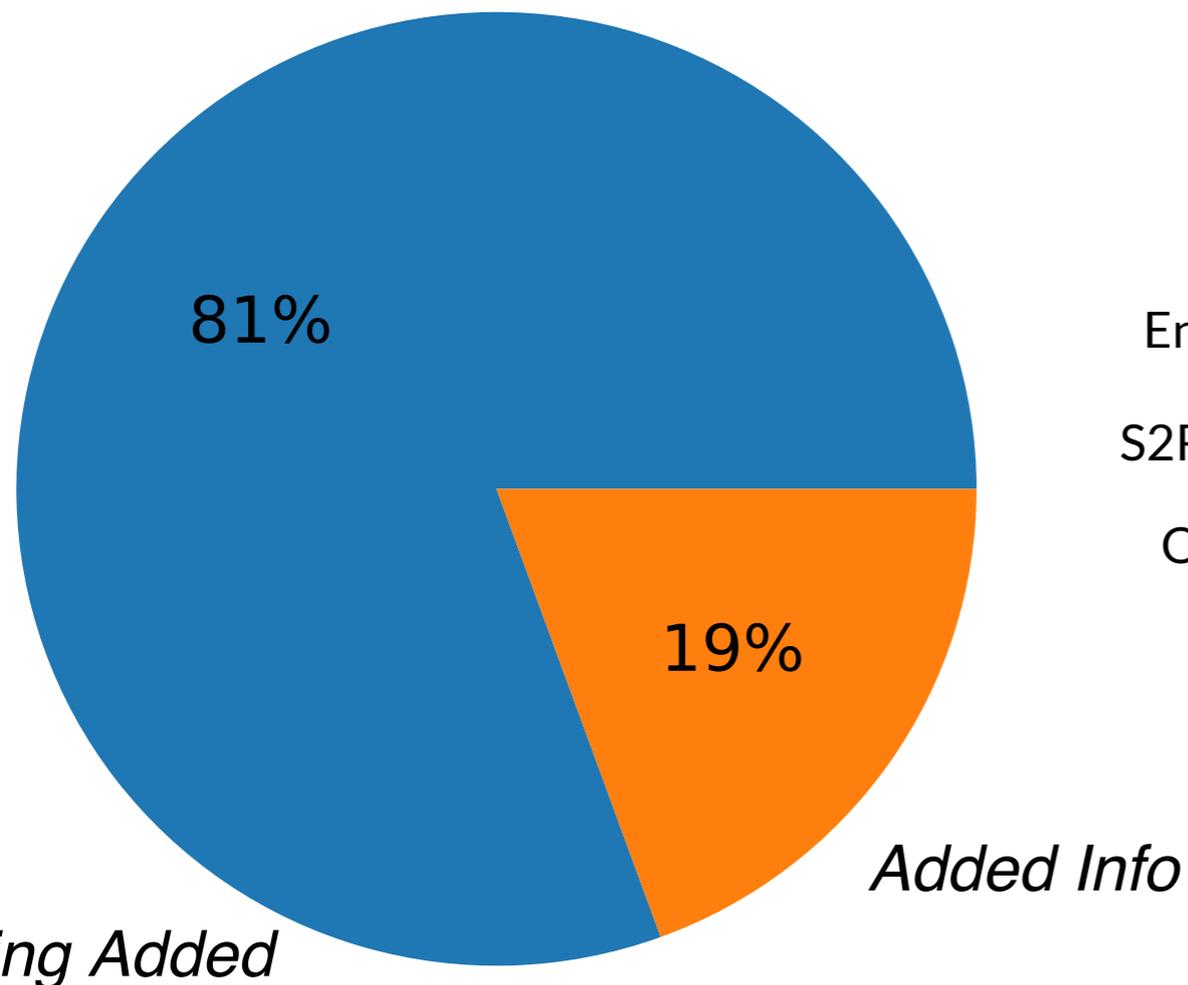
Do reproducible bug reports have missing information?



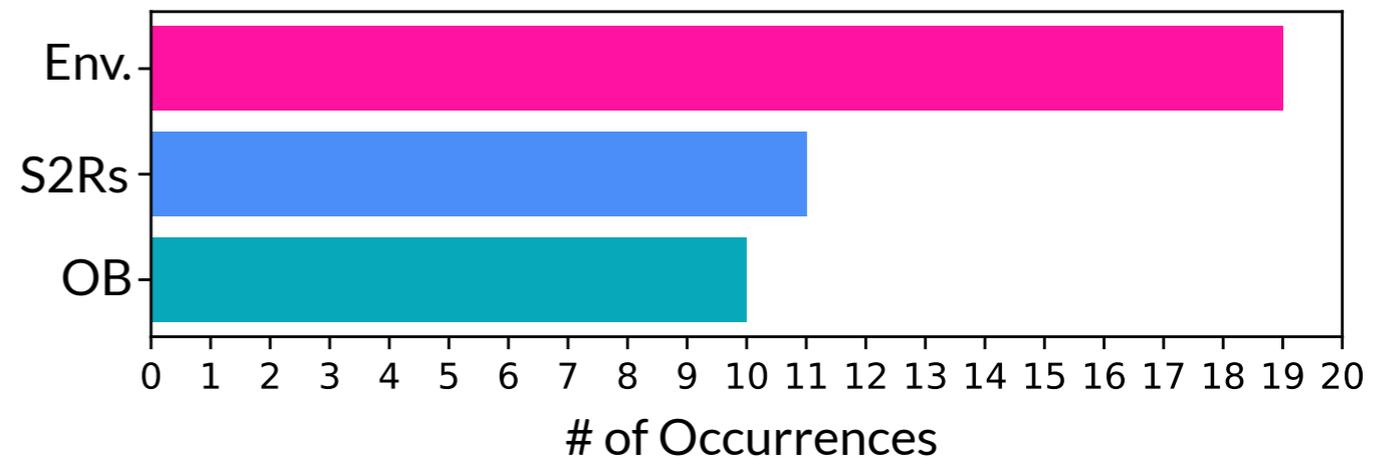
RQ4 Results

Do discussion threads of reproducible bug reports contain helpful information for reproducing the reports?

Issues With Added Information



Type Of Information Added

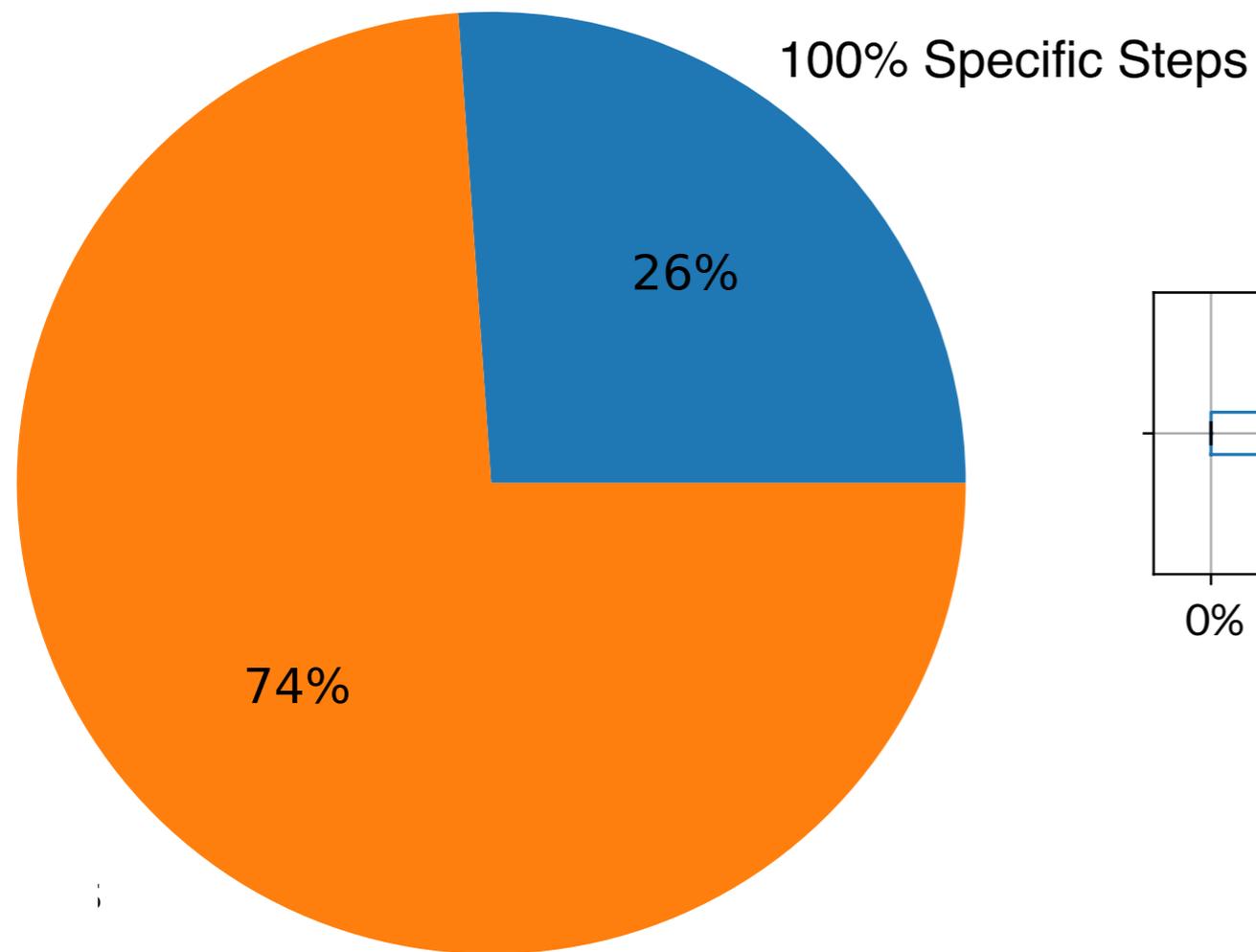


RQ5 Results

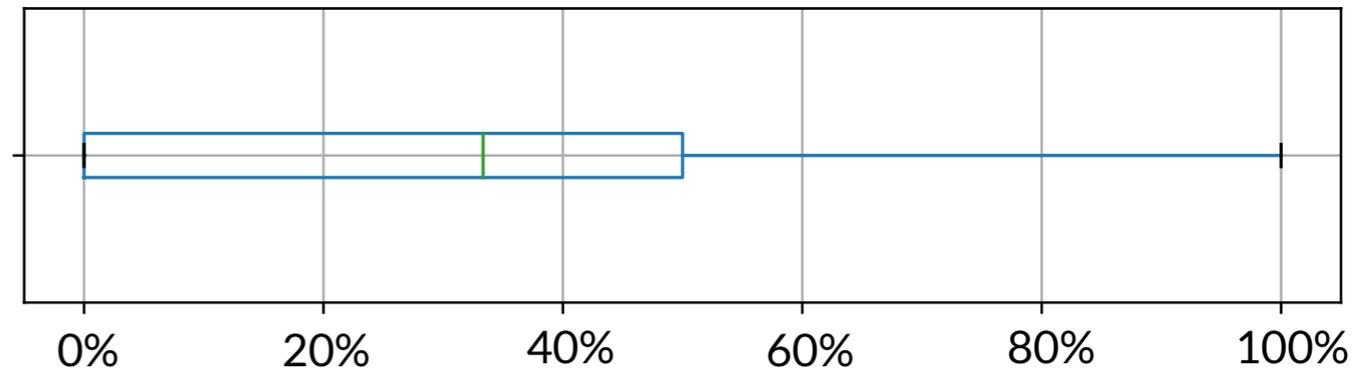
How specific is the information reported in reproducible bug reports?

Bug Reports With Non-Specific Steps

Non-Specific S2Rs Per Bug Report



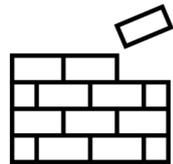
Had Non-Specific Steps



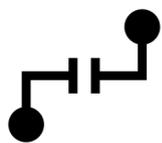
Discussion



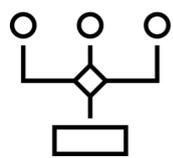
New automated techniques are needed for understanding non-crashing oracles.



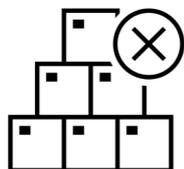
There is a need for automated multi-modal understanding of bug report information.



Many bug reports have missing S2Rs, which need to be accounted for.



Handling non-specific S2Rs in bug report data is a major challenge.



Techniques for inferring and mocking app environments are essential

Summary

Study Overview

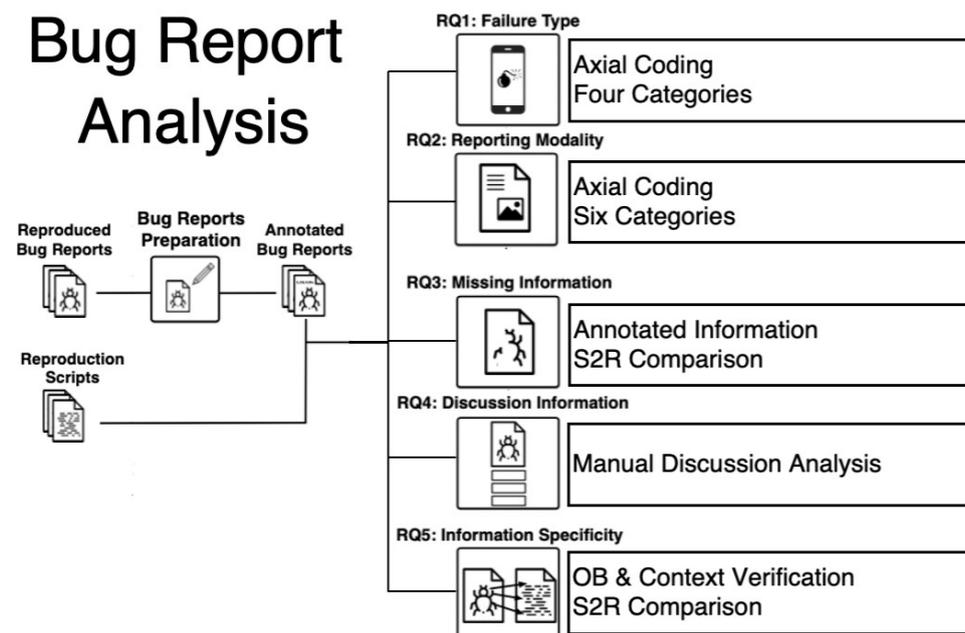
RQ1	What are the failure types associated with reproducible bug reports?
RQ2	What information modalities are used to report the information contained in reproducible bug reports?
RQ3	Do reproducible bug reports have missing information?

Dataset Creation



https://github.com/se-umn/2022_saner_bug_report_reproduction_study

Bug Report Analysis



Discussion

- New automated techniques are needed for understanding non-crashing oracles.
- There is a need for automated multi-modal understanding of bug report information.
- Many bug reports have missing S2Rs, which need to be accounted for.
- Handling non-specific S2Rs in bug report data is a major challenge.
- Techniques for inferring and mocking app environments are essential