Do Java Programmers Write Better Python?
Studying Off-language Code Quality on GitHub

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;

semicolon

terminating lines since ~1958

Java
C++
C
JavaScript
C#

;

Python?

separator:

```
foo.x();foo.y()
```

works,
but discouraged!

```
foo.x();
foo.y()
```

semicolon
terminating lines since ~1958

So, how many
Java programmers
accidentally write…

```
foo.x();
foo.y()
```

… in Python?

;

semicolon
terminating lines since ~1958

Finding Off-language Programmers

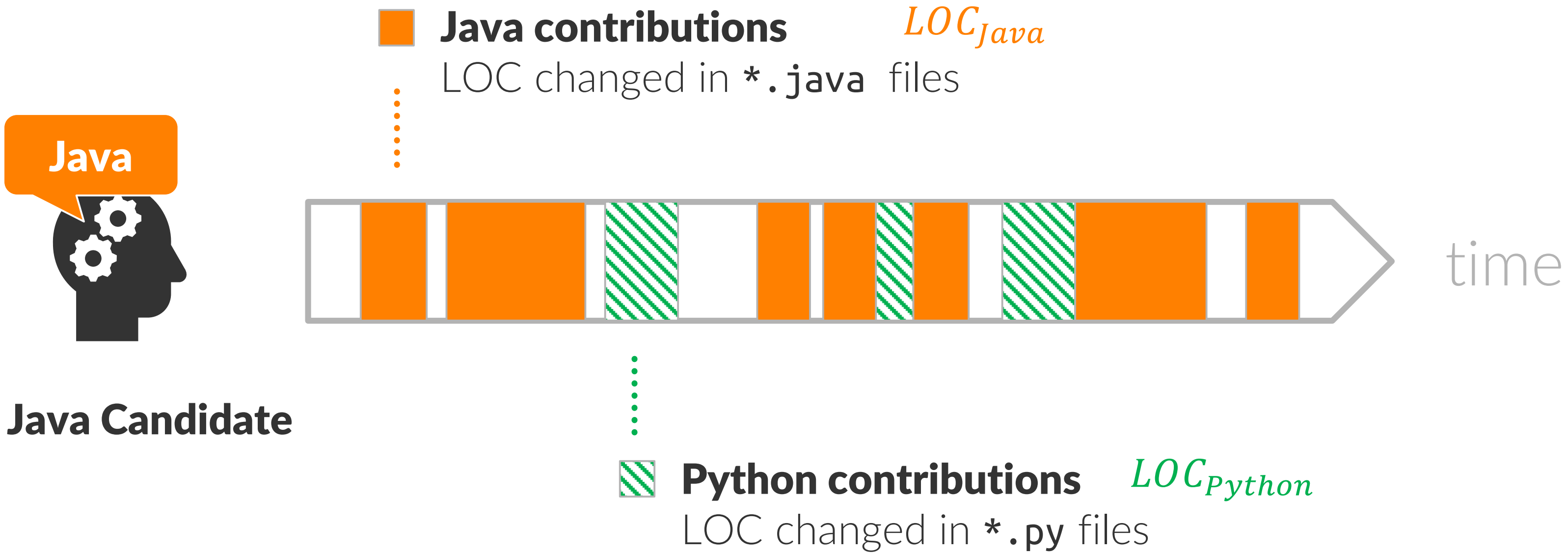
- How to find programmers that
  - primarily work with **Java,** but
  - occasionally switch to **Python**?

- Idea: Open source contributors on GitHub
  - Find **user accounts** that **commit** many LOC to `*.java` files
  - … and sometimes `*.py` files
  - check their **Python** code

- We have a copy of GitHub, based on GHTorrent*
  - ~10TB of commits and user data in PostgreSQL
  - ~250,000 full git repositories on disk

*) http://ghtorrent.org/

Candidate Selection



Java contributions LOC_{Java}
LOC changed in `*.java` files

Java Candidate

Python contributions LOC_{Python}
LOC changed in `*.py` files

$$LOC_{Java} \geq 5 \times LOC_{Python}$$

$$LOC_{Python} \geq 150$$

84 Candidates
of 14,380,149 users

```
SELECT author_id,
    sum(pycommit.changes) as pychanges,
    sum(jcommit.changes) as jchanges
FROM
    (SELECT author_id, sha FROM commits) author

    JOIN
    (SELECT sha, changes FROM raw_patches WHERE name LIKE '%.py') pycommit
    ON author.sha = pycommit.sha

    JOIN
    (SELECT sha, changes FROM raw_patches WHERE name LIKE '%.java') jcommit
    ON author.sha = jcommit.sha

GROUP BY author_id
HAVING pychanges > 150
AND jchanges > (pychanges * 5);
```

Candidates and Projects

Java

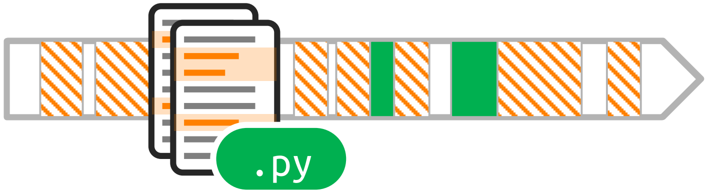
84 Java Candidates

C++

91 C++ Candidates

Python

100 Control Group
(of 1800 Candidates)



40 Projects

.py

33 Projects

.py

380 Projects

Counting end-of-line **semicolons**…

5 out of 1000 LOC
(480,875 LOC in total)

24 out of 1000 LOC
(175,402 LOC in total)

1 out of 1000 LOC
(1,335,220 LOC in total)

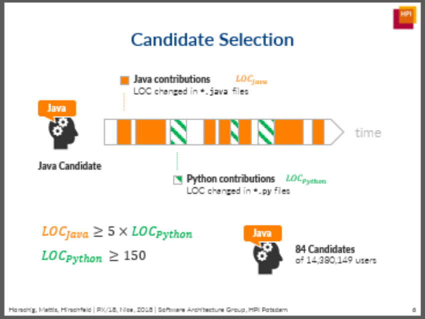
PyLint: Few/Many Methods per Class

Hypothesis: Java/C++ programmers are forced into class-based OOP. They should excel at writing classes.

	Java	C++	Python
Classes with too many Methods	**0.32** of 1000 LOC	**0.18** of 1000 LOC	**0.69** of 1000 LOC
Classes with too few Methods (Data Class)	**5.39** of 1000 LOC	**3.09** of 1000 LOC	**9.22** of 1000 LOC

Some Tentative Conclusions

- » Knowing a language can influence your code style in another language…
  - › **positively** regarding generalizable knowledge (e.g. OOP)
  - › **negatively** regarding peculiarities (e.g. line endings, indentation, built-in names, …)
  - › **Consequence:** The **order** in which we learn/teach languages likely influences our/students' success at another language
- » The **GHTorrent** dataset allows to study such effects with little effort compared to **user studies**



Candidate Selection

Java Candidate

■ Java contributions LOC_{Java}
LOC changed in *.java files

▨ Python contributions LOC_{Python}
LOC changed in *.py files

$LOC_{Java} \geq 5 \times LOC_{Python}$

$LOC_{Python} \geq 150$

84 Candidates
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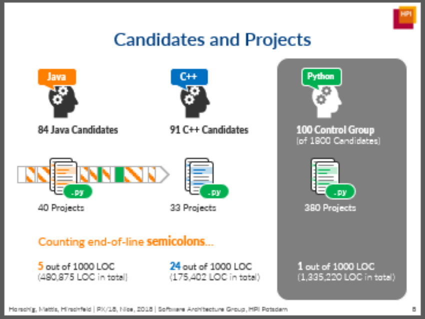

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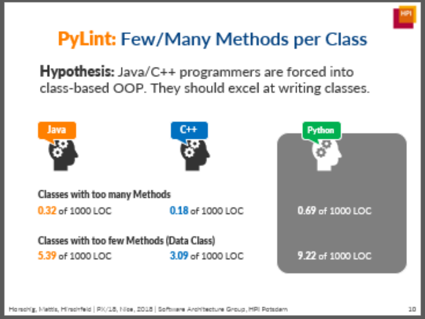

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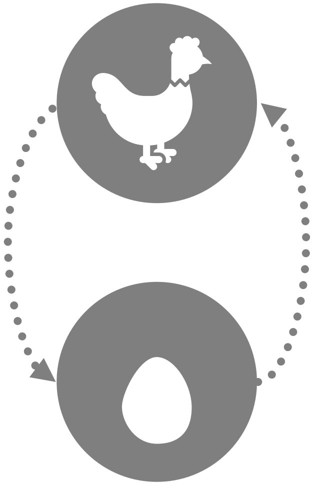
Correlation | Causation | Coincidence

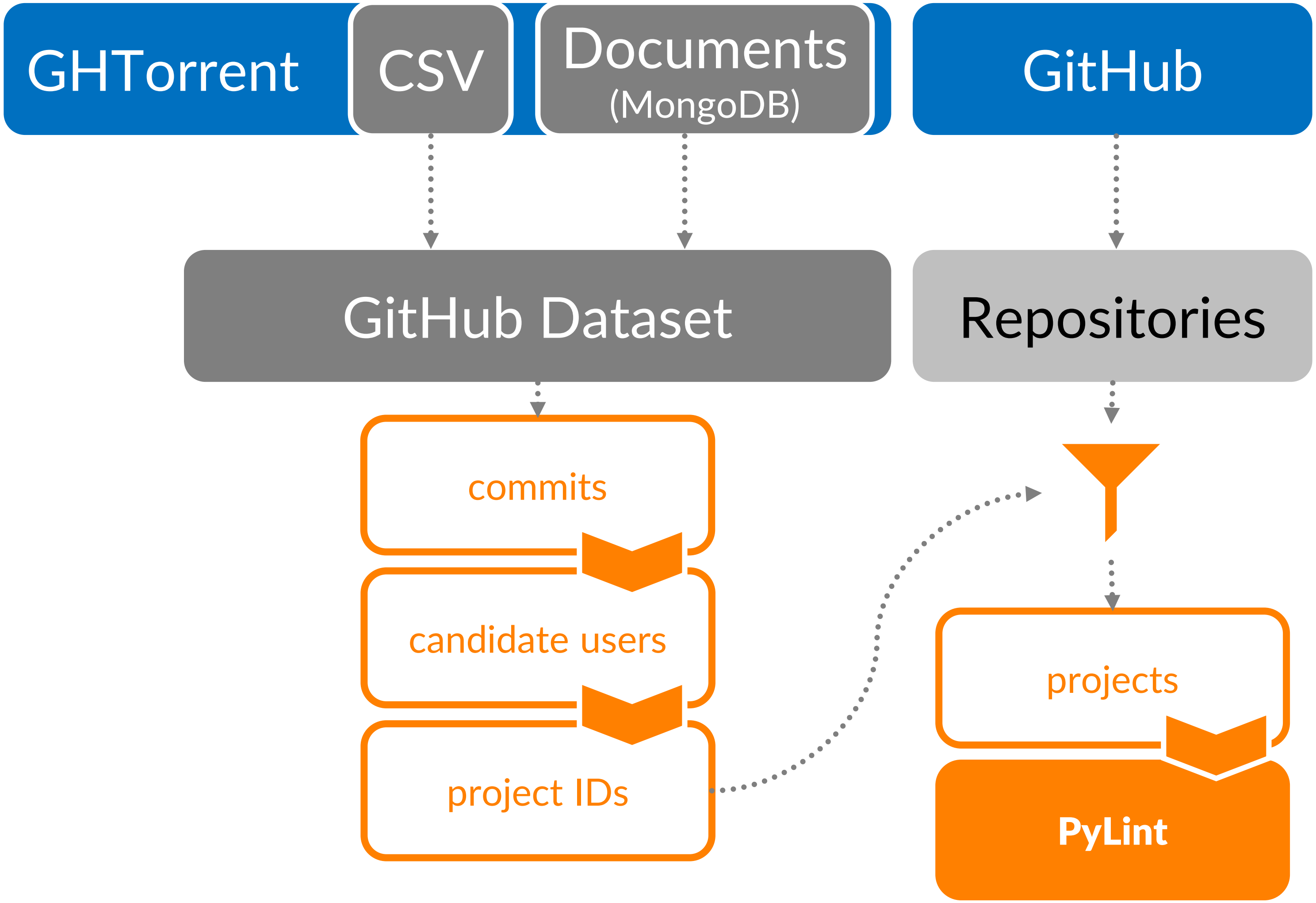
- » **Common unobserved factor** that attracts both semicolons and C++ developers
  Insights limited



- » **Random variation** independent of language
  Limited control via "p < 0.05"

- » **Selection Bias**
  < 0.002% of all GitHub users

Pipeline


GHTorrent
CSV
Documents
(MongoDB)
GitHub
GitHub Dataset
Repositories
commits
candidate users
project IDs
projects
PyLint