How We Refactor, and How We Know It

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Introduction to Refactoring

class Foo{
}
class Bar{
    int a;
    public Bar(int anA){
        this.a = anA;
    }
}
class Bar{
    int a;
    private Bar(int anA){
        this.a = anA;
    }
    public static Bar create(int anA){
        return new Bar(anA);
    }
}
Introduction to Refactoring

Correctness & Speed
Introduction to Refactoring

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Time
3 Research Questions

Do Programmers Usually Floss Refactor?

versus

root-canal refactoring

Do Programmers Refactor Often?

versus

Do Programmers Use Refactoring Tools Often?
Do Programmers Usually Floss Refactor?
Do Programmers Usually Floss Refactor?

If floss refactoring is more common, then tools should support that strategy.

A tool user interface optimized for “root canals”

A tool user interface optimized for “flossings”
Do Programmers Usually Floss Refactor?

What We Already Know

Floss refactoring better by prescription:

In almost all cases, I'm opposed to setting aside time for refactoring. In my view refactoring is not an activity you set aside time to do. Refactoring is something you do all the time in little bursts.  

– Martin Fowler

Avoid the temptation to stop work and refactor for several weeks... Have your team get used to refactoring as part of their daily work.  

– James Shore

Case studies describe root canal refactorings:

Pizka [2004]
Bourquin and Keller [2007]
Do Programmers Usually Floss Refactor?

What We Did and Results

91% of refactorings occurred during floss refactoring
Do Programmers Usually Floss Refactor?
3 Research Questions

Do Programmers Usually Floss Refactor?

Yes

versus

Do Programmers Refactor Often?

versus

Do Programmers Use Refactoring Tools Often?
Do Programmers Refactor Often?
Do Programmers Refactor Often?

Importance

If programmers refactor often then refactoring research matters then refactoring tools may significantly speed up and improve the correctness of programming
Do Programmers Refactor Often?

What We Already Know

According to Xing and Stroulia [2006]:

Refactoring is frequent, in the Eclipse project

But their use of an automated detection tool means the results are only a rough estimate
Do Programmers Refactor Often?

What We Did + Results

4 Developers on the Same Open Source Project

Refactoring Tool Logs in 2006/2007

February 1
Dev. 1

February 1
Dev. 2

February 3
Dev. 4

February 4
Dev. 3

February 8
Dev. 3

February 11
Dev. 4

Week 1

Week 2

2006

2007

But this is tool-based refactoring. If many refactorings are done without tools, then refactoring is even more frequent.
Do Programmers Refactor Often?
3 Research Questions

Do Programmers Usually Floss Refactor?

Yes

Do Programmers Refactor Often?

versus

Yes

Do Programmers Use Refactoring Tools Often?

versus
Do Programmers Use Refactoring Tools Often?
Do Programmers Use Refactoring Tools Often?

If programmers underuse refactoring tools:

then there’s potential for tool improvements

then programmers are needlessly introducing errors or refactoring slowly
Do Programmers Use Refactoring Tools Often?

What We Already Know

From our previous work

2 in 16 programming students used them (and even then, 20% and 60% of the time)

Agile developers (in 2007, n=112) estimate that they use them only 68% of the time

6 of 42 people who used Eclipse on networked PSU computers used refactoring tools
Do Programmers Use Refactoring Tools Often?

What We Did

![Comparison of Java files](image-url)

Jan. 29, 08:40
Dev. 2

Feb. 1, 15:11
Dev. 1

Feb. 1, 15:59
Dev. 1

Feb. 1, 16:00
Dev. 2

Feb. 1, 12:23
Dev. 1

Dev. 1 Commit
Feb. 1, 15:01

Dev. 1 Commit
Feb. 1, 15:23
Do Programmers Use Refactoring Tools Often?

What We Did
Do Programmers Use Refactoring Tools Often?

<table>
<thead>
<tr>
<th>The Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>89% of refactorings were done <em>without</em> a tool</td>
</tr>
<tr>
<td>... among toolsmiths.</td>
</tr>
</tbody>
</table>
Do Programmers Use Refactoring Tools Often?
3 Research Questions

Do Programmers Usually Floss Refactor?

Yes

Do Programmers Refactor Often?

Yes

Do Programmers Use Refactoring Tools Often?

No versus
6 More Findings

The kind of refactoring performed with tools differs from the kind performed manually

Toolsmiths use a wider array of refactoring tools than tool users

About 40% of tool-initiated refactorings occur in batches

About 90% of tool-initiated refactorings do not require configuration of the tool

Messages written by programmers in version histories are unreliable indicators of refactoring

About 40% of refactorings will not be detected by most mining tools that detect refactoring from version histories
Conclusion

The more ways we look at how people refactor, the more confidence we have that we understand how people refactor.

In studying refactoring from new perspectives, our findings have confirmed – and refuted – previous knowledge about how people refactor.