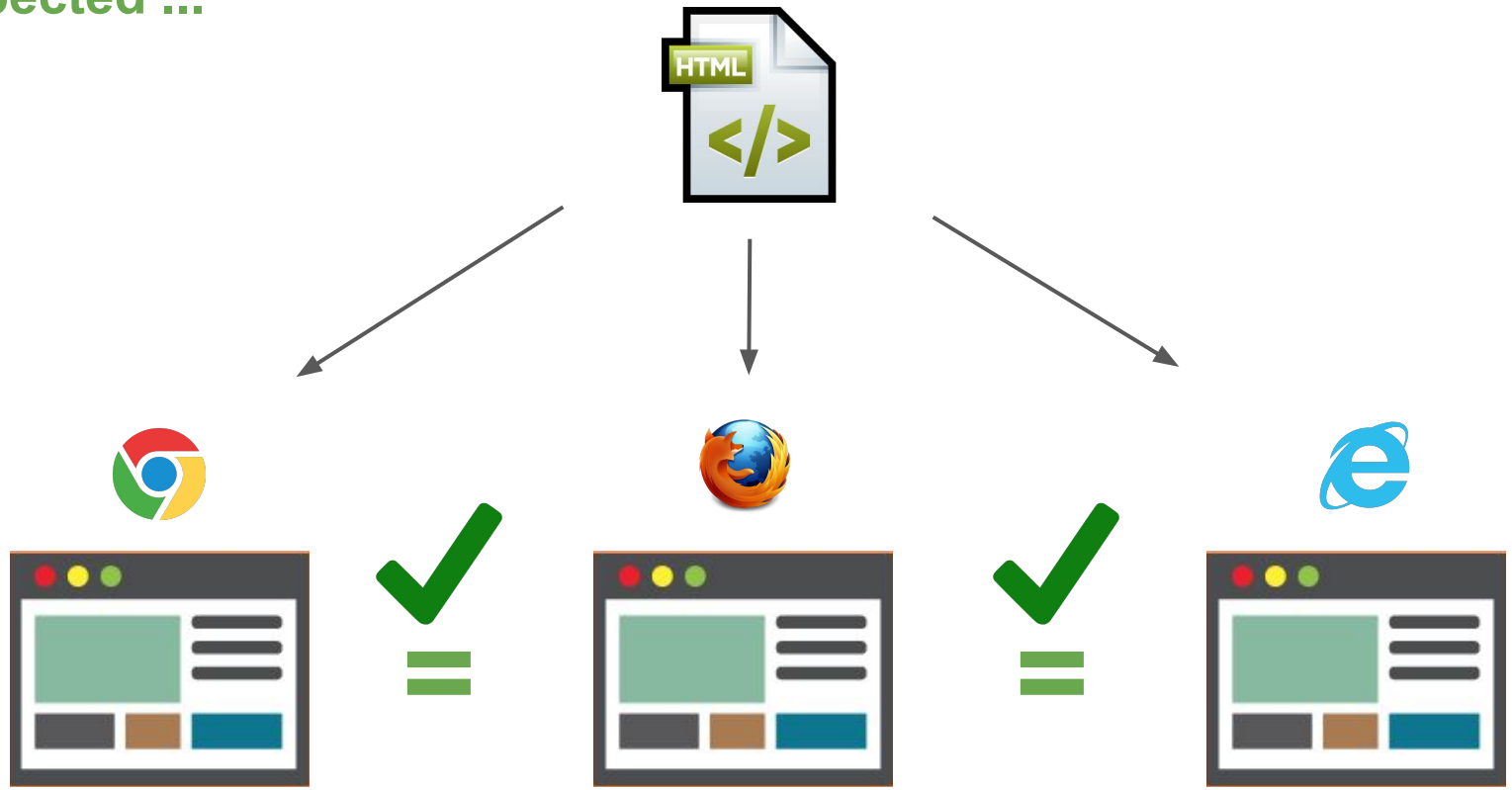
Cross-browser Compatibility Checker

By Arthur Marques, Mohammad Bajammal and Rodrigo Araujo

Cross-browser compatibility

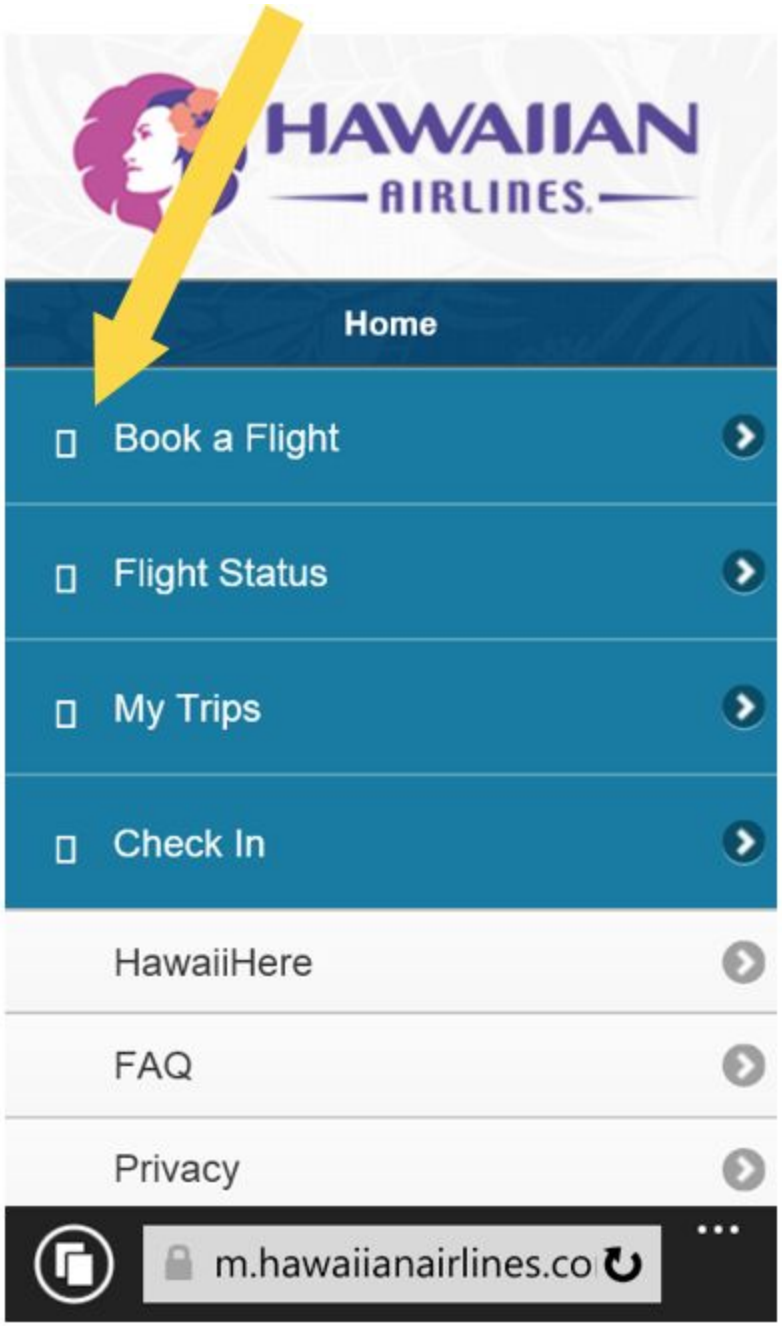
Expected ...

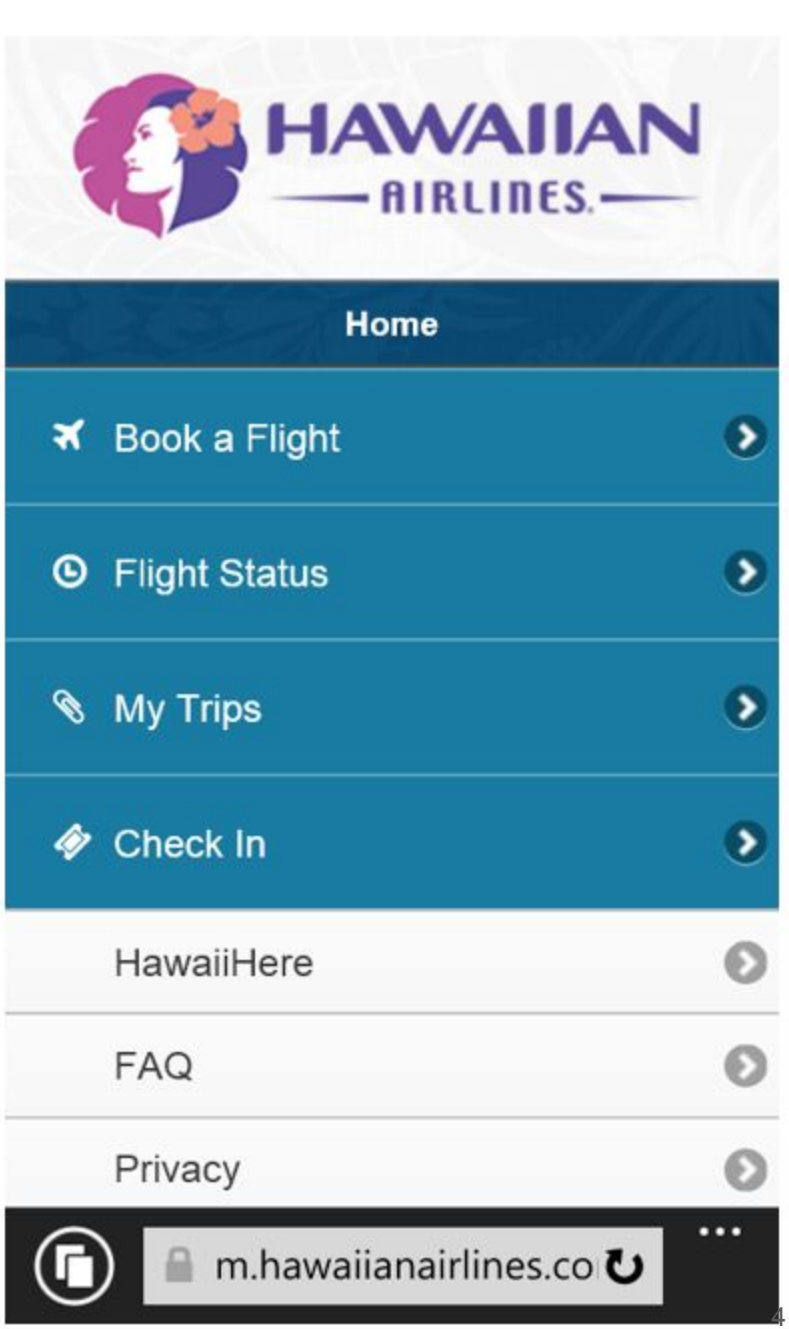


Cross-browser compatibility

Reality!

http://static.fjcdn.com/pictures/Web_c43d4b_1532437.jpg





Source: https://blogs.windows.com/msedgedev/2015/06/17/building-a-more-interoperable-web-with-microsoft-edge/#sdSp5A4uSULsBMAM.97

Example


Listing 1: An example of cross-browser incompatibilities in an HTML snippet.

```
1  <img src="student-id.png" onclick="
       openProfile(event)" />
```

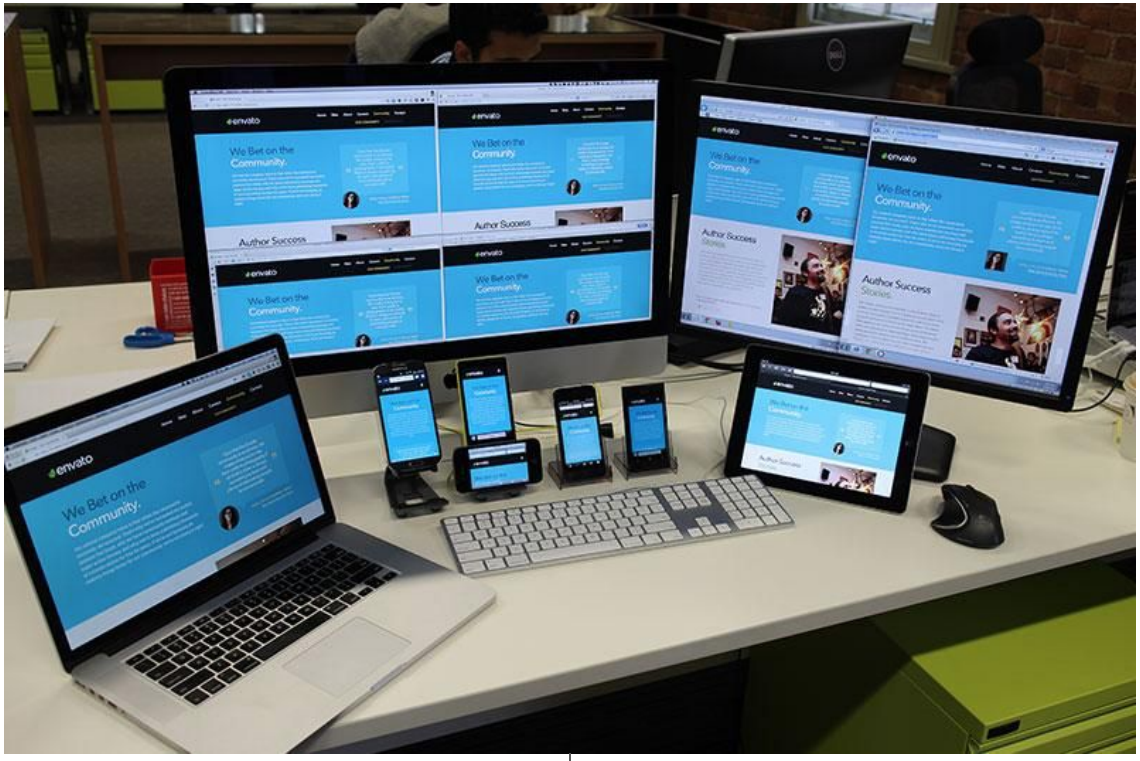

Listing 2: An example of cross-browser incompatibilities in a CSS snippet.

```
1  h1 { text-shadow: blue 2px 2px 2px;}
```


Listing 3: An example of cross-browser incompatibilities in a JavaScript snippet.

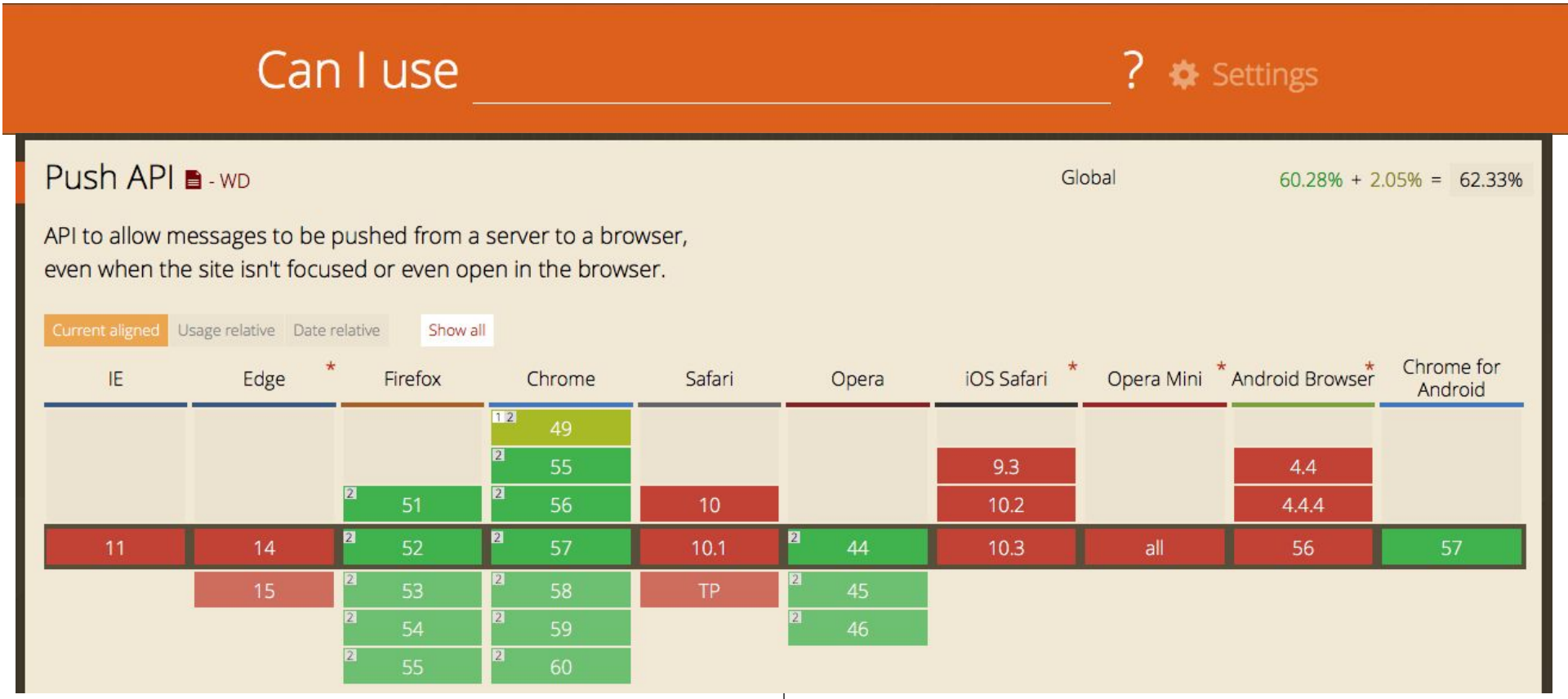
```
1  var txt = $("items").childElementCount + "
       enrolled courses";
2  $("ncourses").innerHTML = txt;
```


Existing Approaches



- Expensive
- Time consuming, manual
- Mostly pair-wise comparisons
- Can keep up with # of platforms out there **?**

Existing Approaches



Requires existing knowledge of incompatibilities

Manual querying

Based on features, not **code-specific**

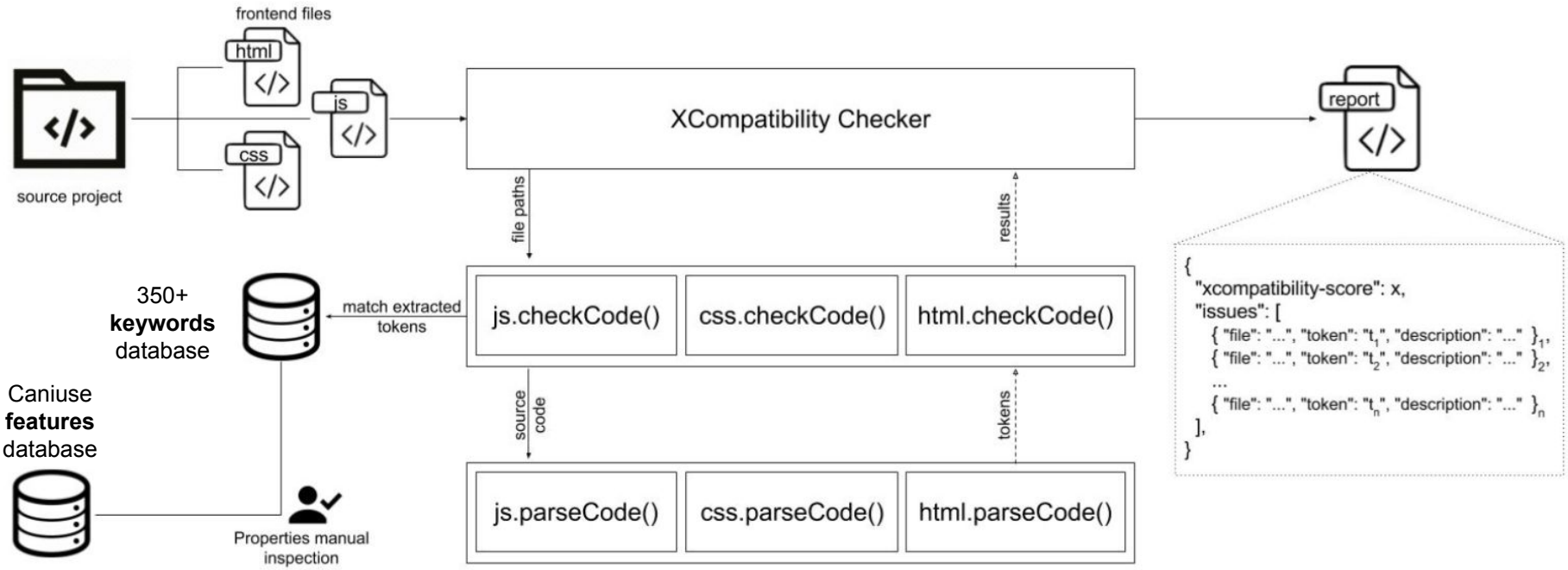
Returns multiple entries

XCompatibility-Checker

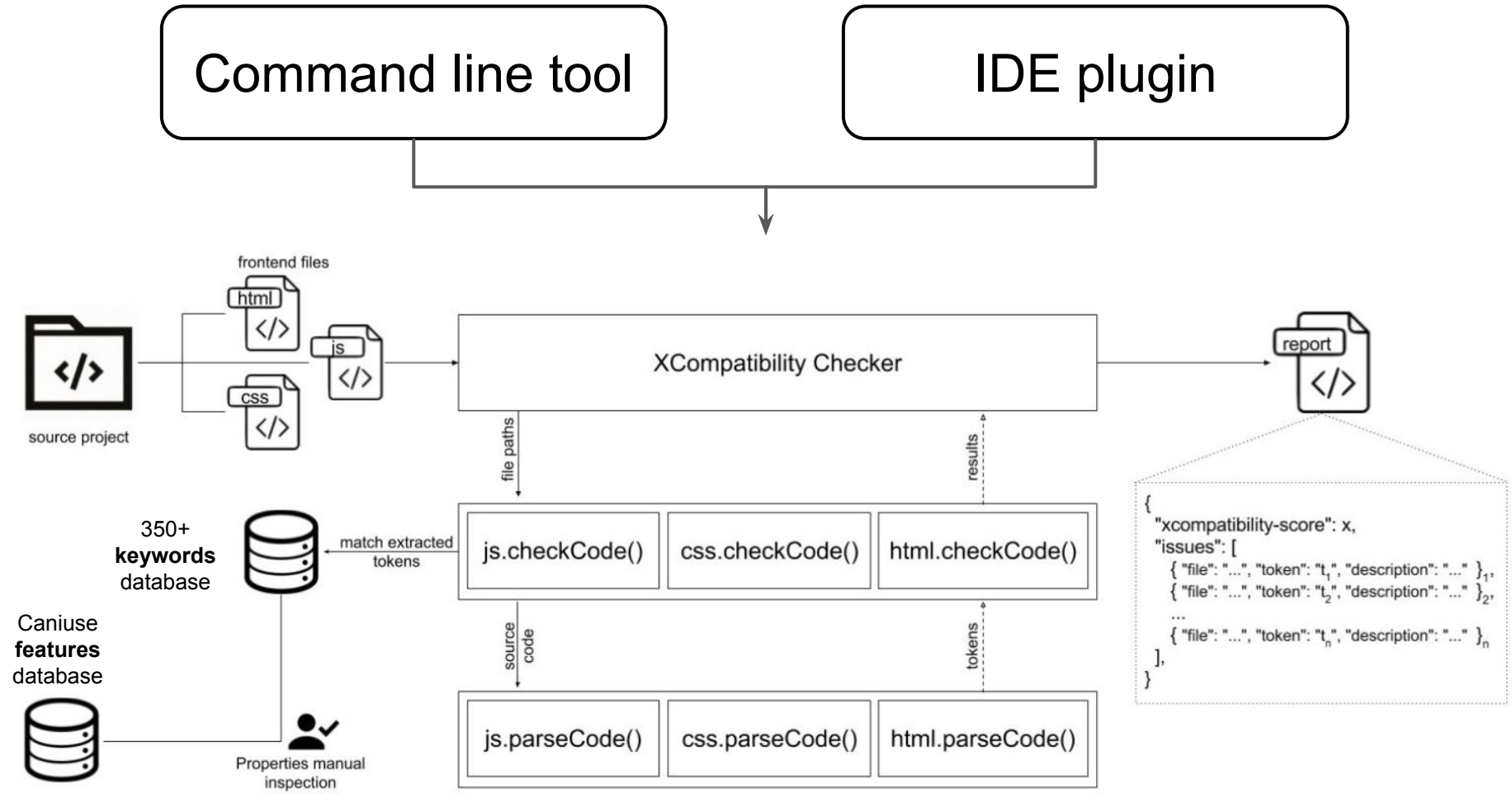
A tool to detect cross-browser incompatibilities:

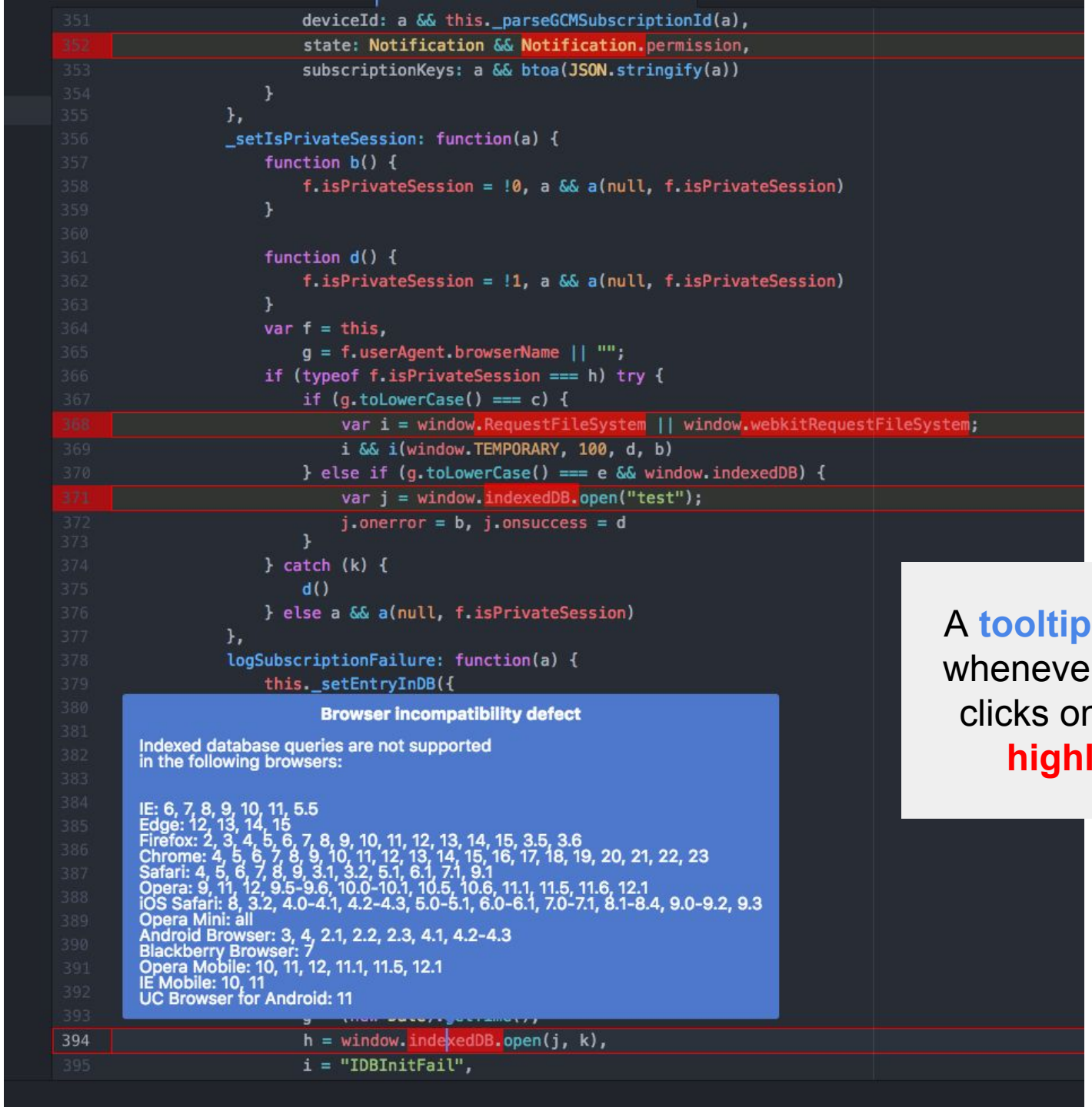
- **Automatically**, in **real-time**
- **At any stage of development**
  (from first line to last push)
- Does not require **existing knowledge** of incompatibilities

Proposed Tool



Proposed Tool





A **tooltip** is shown whenever the user clicks on the **red highlights**

Evaluation

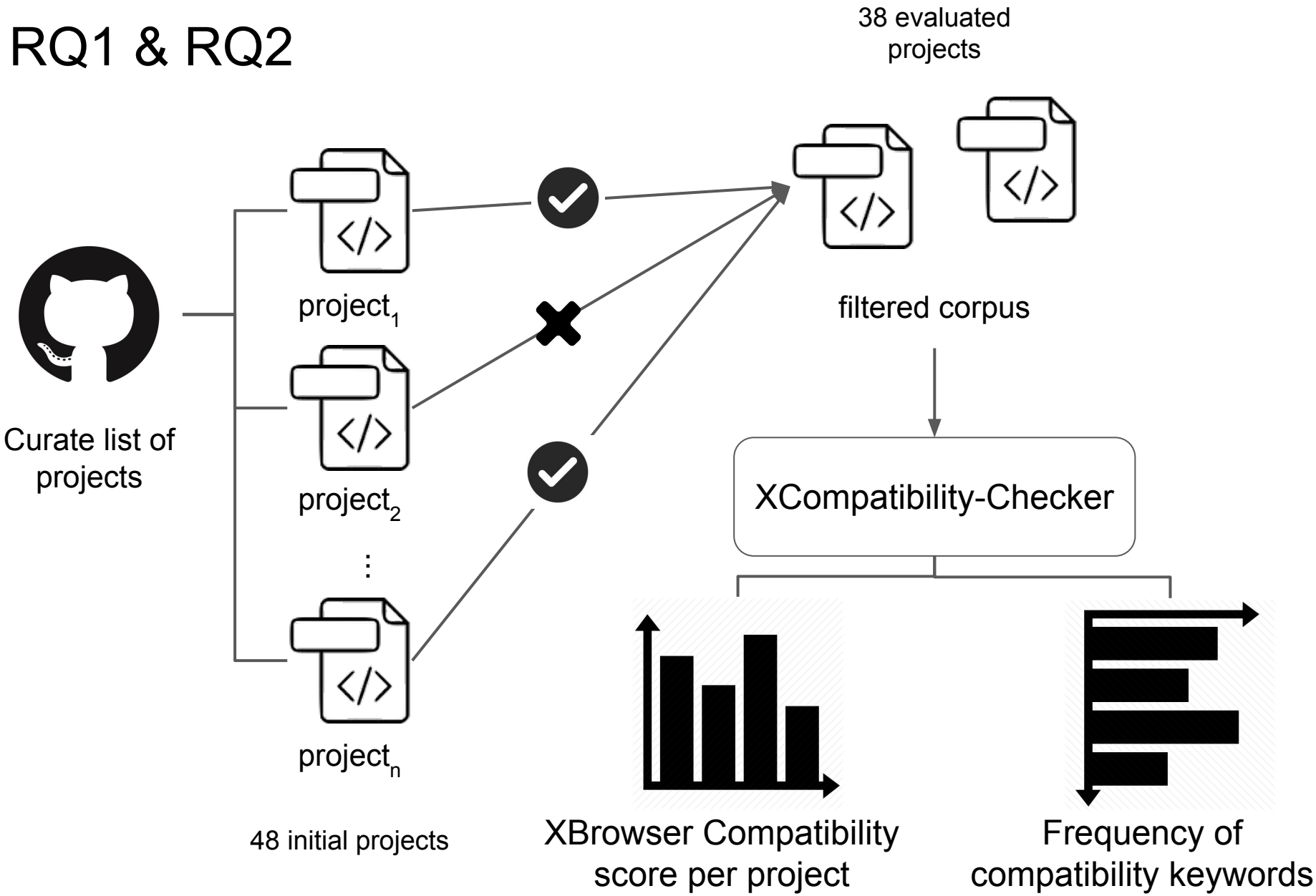
Research Methodology

RQ1: How often do cross-browser incompatibilities occur?

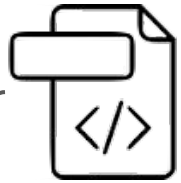
RQ2: What are the most common cross-browser incompatibilities?

RQ3: Does a recommendation system improve developers' awareness of cross-browser incompatibilities?

RQ1 & RQ2


38 evaluated projects
project1
project2
projectn
Curate list of projects
48 initial projects
filtered corpus
XCompatibility-Checker
XBrowser Compatibility score per project
Frequency of compatibility keywords

RQ3



Amazon
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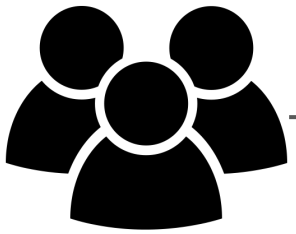
Yahoo

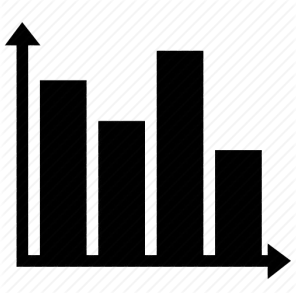


Grad students

Code review tasks

Non-augmented IDE

IDE augmented with the proposed tool



reported incompatibilities

post-experiment survey

RQ3: Post-experiment survey

Based on the **technology acceptance model questionnaire** [Davis '89]

questions on perceived usefulness
Q1: Using the defect highlighting tool enables me to accomplish tasks more quickly
Q2: Using the defect highlighting tool increases my productivity
Q3: Using the defect highlighting tool makes it easier to do my job
Q4: I would find the defect highlighting tool useful in my job
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Q5: Learning to operate the defect highlighting tool is easy for me
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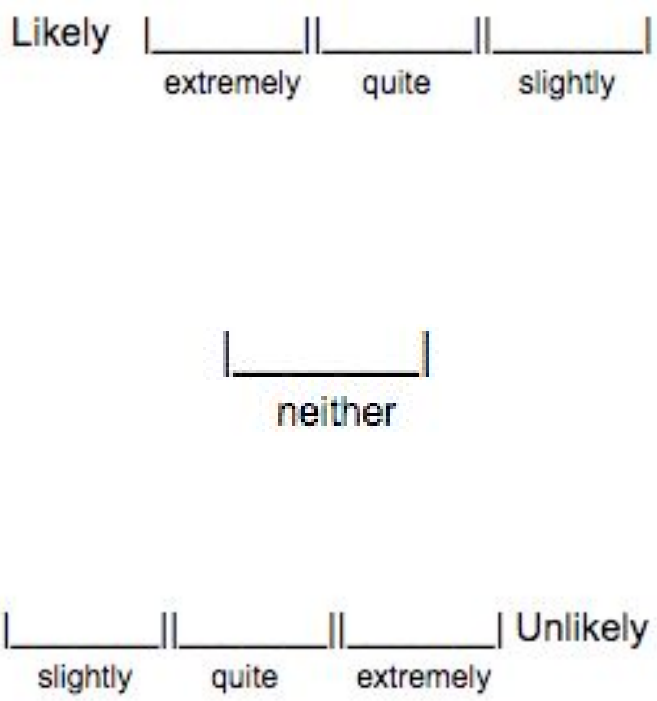

RQ1: What is the overall measured cross-browser compatibility?

- #Projects with XBC score greater than 90% threshold
  - **14 projects (36%)**

- #Projects with XBC score lower than threshold
  - **24 projects (64%)**
  - The median XBC score of those projects state that they are compatible with only **19%** of current existing browsers

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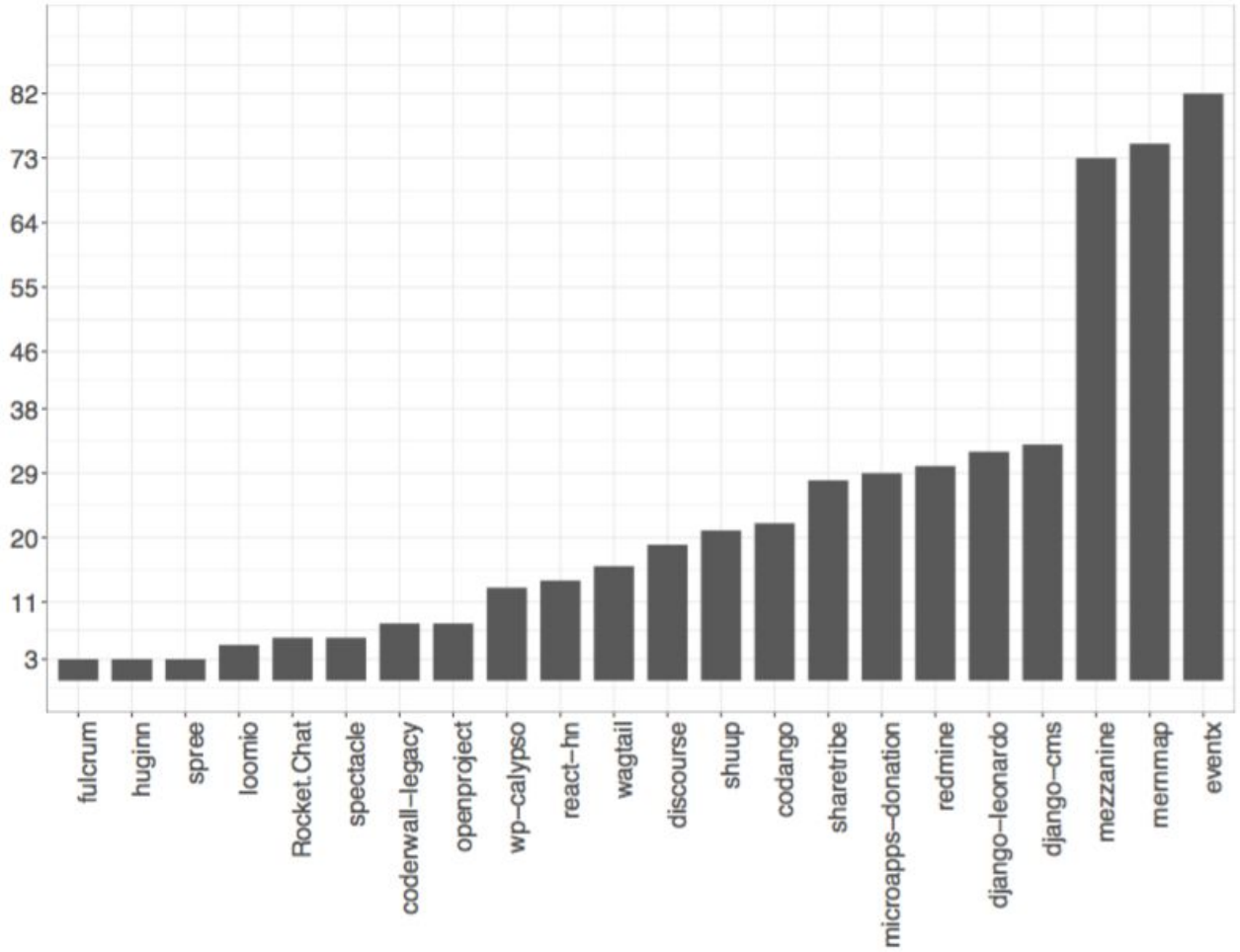

Number of incompatibilities per project

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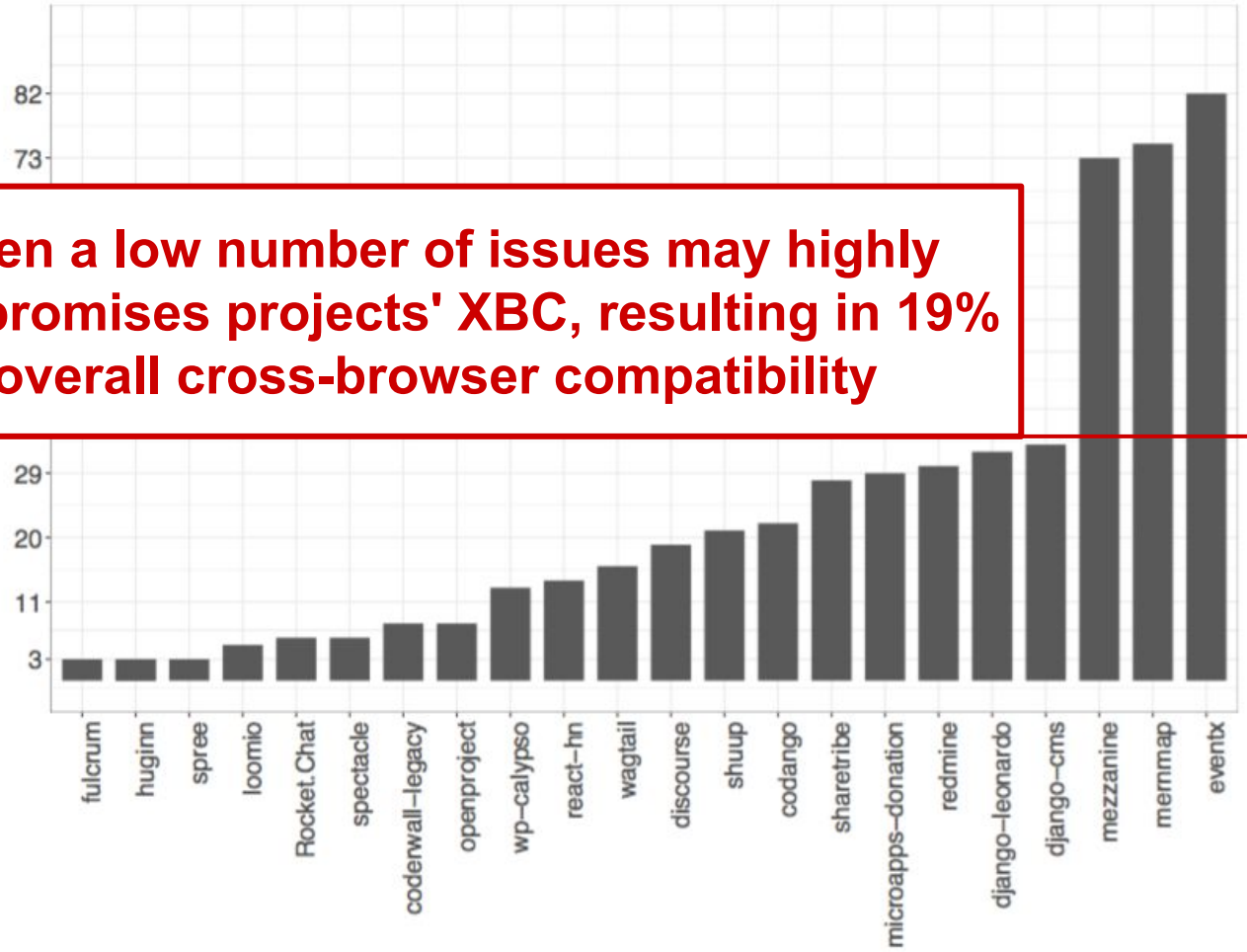
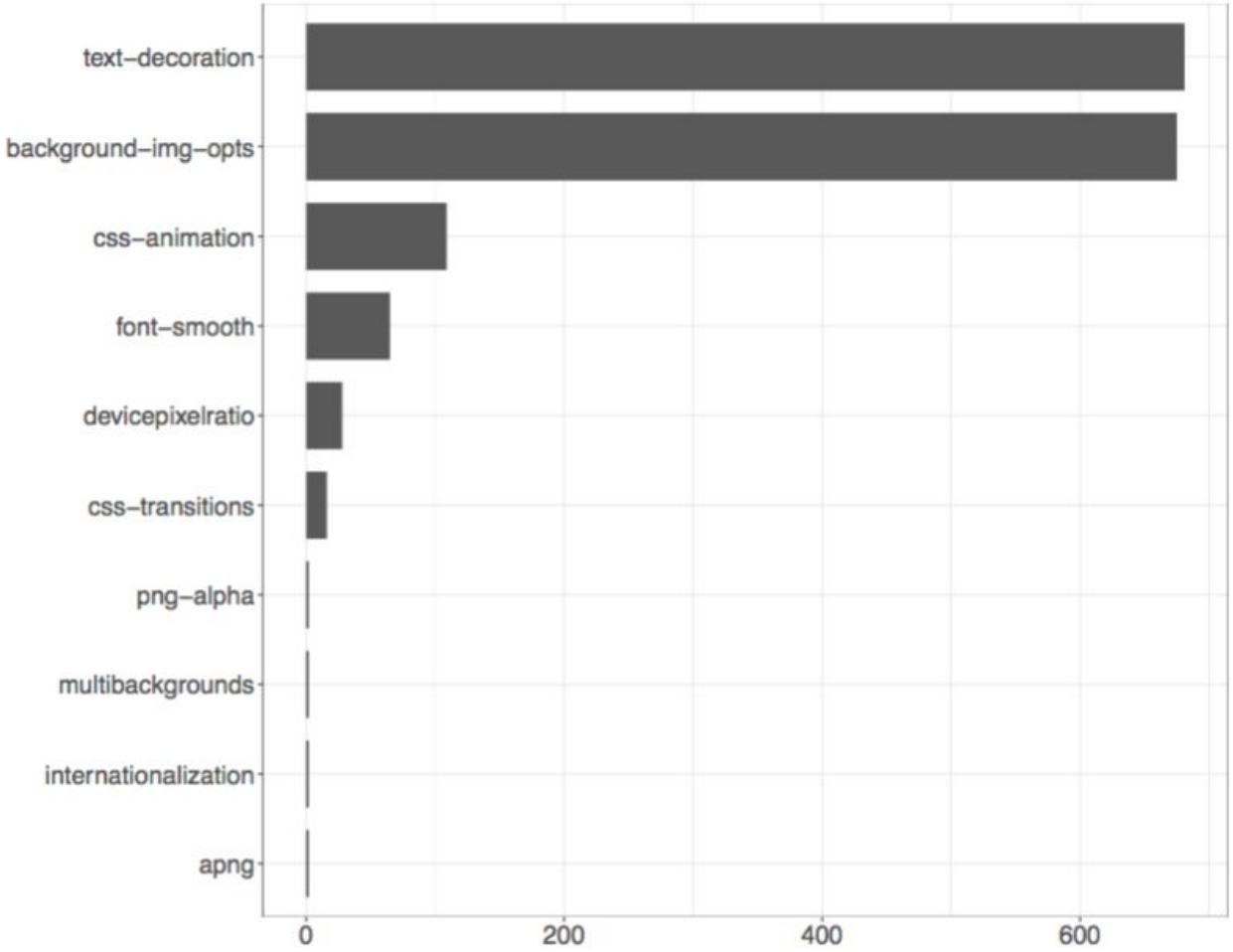


Even a low number of issues may highly compromises projects' XBC, resulting in 19% overall cross-browser compatibility

Number of incompatibilities per project

RQ2: What are the most frequent cross-browser incompatibility issues?



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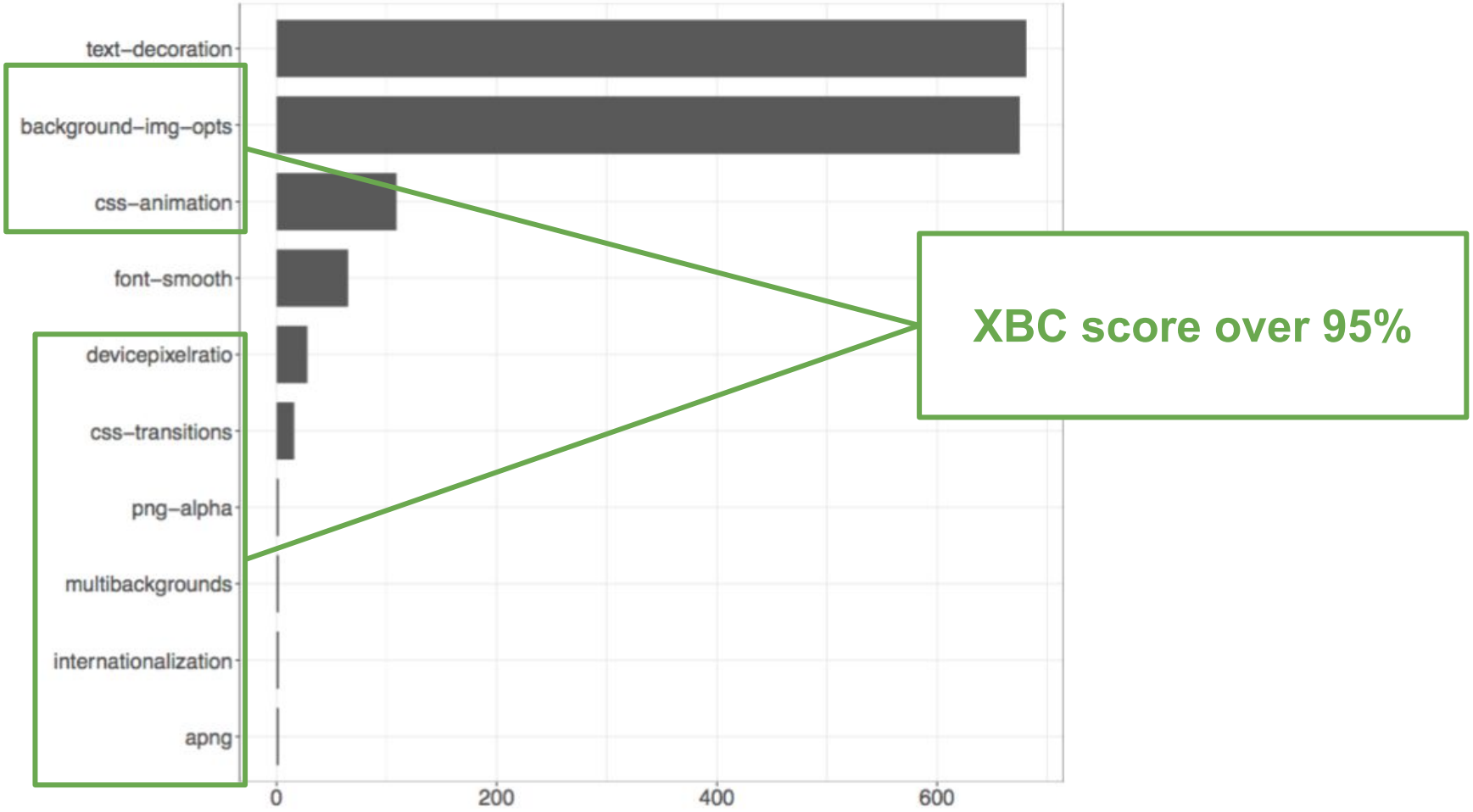

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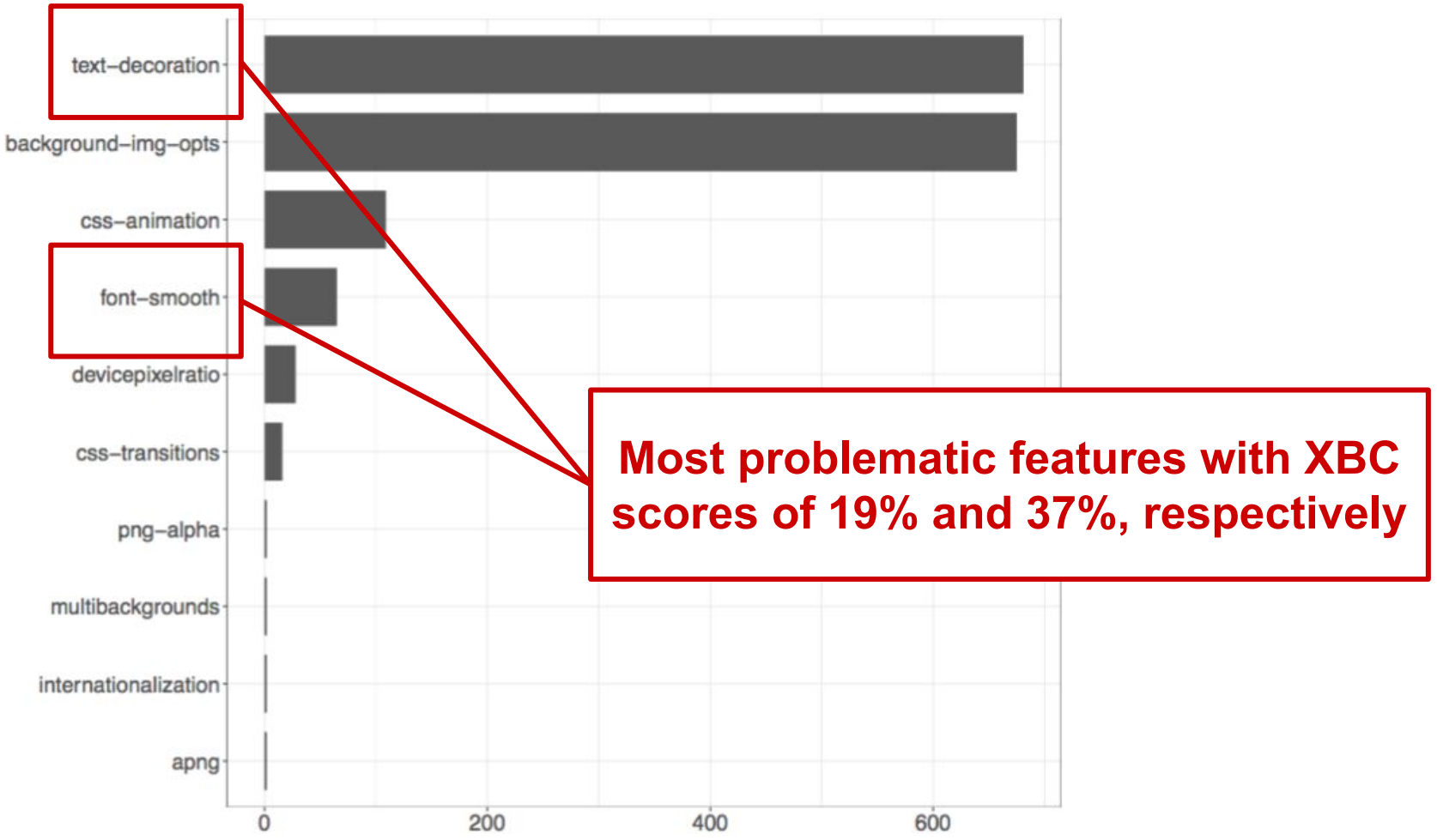

RQ3: Does a recommendation system improve awareness?

Table 4: Results of user study for the proposed IDE tool

participant #	task	proposed IDE tool on/off	task duration (minutes : seconds)	# of reported incompatibilities
1	A	off	6:50	8
1	B	off	4:44	8
1	C	on	7:27	28
1	D	on	5:41	12
2	D	off	10:11	2
2	C	on	7:41	7
2	B	off	6:24	1
2	A	on	7:19	10
3	C	off	12:56	5
3	D	off	3:47	0
3	A	on	14:32	22
3	B	on	6:13	14
4	B	on	6:48	13
4	A	off	7:33	4
4	D	on	5:46	34
4	C	off	5:32	2

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Conclusion: the IDE tool results in more awareness of cross-browser incompatibilities:

- Task A: 4 - 8 (tool off) vs. 10 - 22 (tool on)
- Task B: 1 - 8 (tool off) vs. 13 - 14 (tool on)
- Taks C: 2 - 5 (tool off) vs. 7 - 22 (tool on)
- Task D: 0 - 2 (tool off) vs. 12 - 34 (tool on)

RQ3: Does a recommendation system improve awareness?

Post-experiment survey

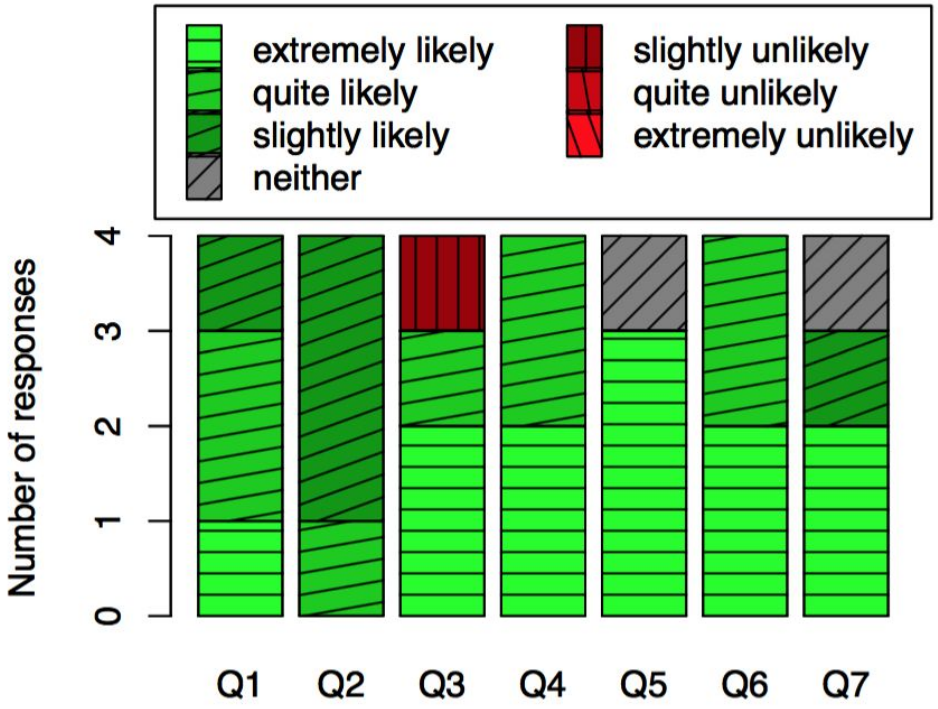

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Figure 5: Post-experiment survey of participants.

RQ3: Does a recommendation system improve awareness?

“I mostly detected any incompatibilities visually”

“The code highlight is very nice, but it's not immediate to know where it is in the visual page”

“[manually] looking up the compatibility of every feature is tedious, and unlikely to happen for many developers”

“It was very easy [to use] because it directs your attention towards finding potential inconsistencies”

Threats

- Lower bound value on XBC scores
  - Usage of parsers hinder the detection of embedded code, e.g. javascript inside html script blocks
  - Some projects use files that could not be parsed

- Low number of participants and lack of statistical power to derive conclusions

- Small number of open source projects that may not reflect more elaborate features used by web designers in industry

Conclusions

- XCompatibility-checker is an IDE + command-line tool to detect incompatibilities
- **64%** of the evaluated projects have **incompatibility** issues and roughly a XBC score of only **19%**
- A recommendation system **does** seem to **improve** awareness of cross-browser incompatibilities
- Majority of survey responses had a **favorable opinion** on the usefulness and ease of use of the tool

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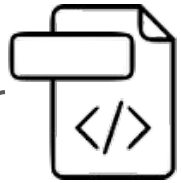
BACKUP

RQ3



Amazon
Walmart
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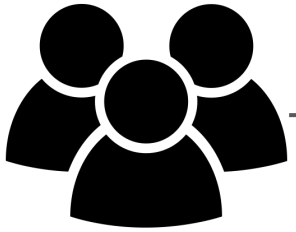
IDE without the proposed tool



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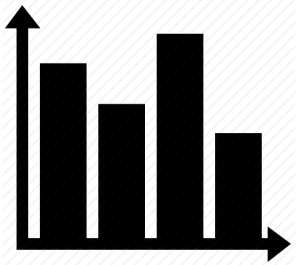

reported incompatibilities

post-experiment survey

Conclusion

- XCompatibility-checker is an IDE + command-line tool to detect incompatibilities
- The tool is able to detect incompatibilities in 64% of the evaluated projects
- A recommendation system **improves** software developers' awareness of incompatibilities
  - Tool's feedback was fairly positive

RQ1: 14 projects (36%) without xbc issues

- **Preemptive Issues**
  “the components do need to have some default styling and structure, so I’m not sure there’s anyway around including some BS3 styles when needed for compatibility."

ReactionCommerce GitHub issue #370

RQ1: 24 projects (64%) with xbc issues

- **Reactive Issues**
  "IE 9 can not select issues, does not display context menu"

  Redmine defect #7954