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AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
A LONG TIME AGO...
THE WEB TODAY
WHY SUPPORT ALL DEVICES?
HOW CAN DEVELOPERS MAKE WEBSITES SUPPORT ALL DEVICES?

USE RESPONSIVE WEB DESIGN.
RESPONSIVE WEB DESIGN

http://getbootstrap.com
RESPONSIVE LAYOUT FAILURES

THOMAS WALSH
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AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
RESPONSIVE LAYOUT FAILURES
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Automated Layout Failure Detection for Responsive Web Pages Without an Explicit Oracle
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RESPONSIVE LAYOUT FAILURES

AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
HOW DO DEVELOPERS TEST RESPONSIVE WEBSITES?

THEY “SPOT-CHECK”.

WHAT IS THE ORACLE FOR RESPONSIVE WEBSITES?

THE HUMAN TESTER.
A SPOTCHECKING EXAMPLE

320 pixels
768 pixels
1024 pixels
1200 pixels

980 pixels
SUMMARY OF APPROACH

Automated Layout Failure Detection for Responsive Web Pages without an Explicit Oracle

Thomas Walsh
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Responsive Layout Graph (RLG)

Common Responsive Layout Failure Detection
THE RESPONSIVE LAYOUT GRAPH

320 pixels

320px-767px, centre-justified
768px-1400px, left-justified

768 pixels

320px-767px, above
768px-1400px, left-of

320PX-1400PX
BODY

320PX-1400PX
DIV[2]

320PX-1400PX
DIV[3]

768PX-1400PX
IMG

320PX-1400PX
DIV[1]
RLF 1 – ELEMENT COLLISION

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AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
MidwayMeetup Where do you want to meet up?

Enter the starting location for each member of your group, one at a time, in the box above. You can use a full address, a zip code, a city name, or even just cross streets -- we'll do our best find it.

Then, enter the type of place you'd like to go ('coffee', 'movie theater', 'Italian food', etc.) in the search box above the map, and click Go!

MidwayMeetup will find places where all of your friends can meet up and display them on the map.

Once you've entered the starting locations of the members of your group, and told us the kind of place for which you're looking, we'll list your results here.

Clicking on a result will highlight its location on the map, and will give you the option to read reviews, visit their website, or even get directions!

MidwayMeetup is currently in open beta. If you have any suggestions or ideas for improvement, please contact the developer at midwaymeetup@gmail.com.

Thank you!
Enter the starting location for each member of your group, one at a time, in the box above. You can use a full address, a zip code, a city name, or even just cross streets -- we'll do our best to find it.

Then, enter the type of place you'd like to go.
RLF 1 – ELEMENT COLLISION

1. Check whether any pair of elements are overlapping at any point.

2. If two elements are overlapping, check the layout at the wider viewport width.

3. If elements no longer overlapping, report an element collision failure.
MidwayMeetup Where do you want to meet up?

Enter the starting location for each member of your group, one at a time, in the box above. You can use a full address, a zip code, a city name, or even just cross streets — we’ll do our best find it.

Then, enter the type of place you’d like to go (‘coffee’, ‘movie theater’, ‘Italian food’, etc.) in the search box above the map, and click Get.

MidwayMeetup will find places where all of your friends can meet up and display them on the map.

Once you’ve entered the starting locations of the members of your group, and told us the kind of place for which you’re looking, we’ll list your results here.

Clicking on a result will highlight its location on the map, and give you the option to read reviews, visit their website, or even get directions!

MidwayMeetup is currently in open beta. If you have any suggestions or ideas for improvement, please contact the developer at midwaymeetup@gmail.com.

Thank you!

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RLF 1 - ELEMENT COLLISION

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3. If elements no longer overlapping, report an element collision failure.
RLF 1 - ELEMENT COLLISION

MidwayMeetup Where do you want to meet up?

Enter a starting address: [input field]

What do you want to find: [input field]

Get

Enter the starting location for each member of your group, one at a time, in the box above. You can use a full address, a zip code, a city name, or even just one street – we’ll do our best to find it.

Then, enter the type of place you’d like to go (coffee, movie theater, Italian food, etc.) in the search box above the map, and click Get!

Once you’ve entered the starting locations of the members of your group, and told us the kind of place for which you’re looking, we’ll list your results here.

Clicking on a result will highlight its location on the map, and will give you the option to read reviews, visit their website, or even get directions!

MidwayMeetup is currently in open beta. If you have any suggestions or ideas for improvement, please contact the developer at midwaymeetup@gmail.com.

Thank you!
1. Check whether any pair of elements are overlapping at any point.

2. If two elements are overlapping, check the layout at the wider viewport width.

3. If elements no longer overlapping, report an element collision failure.
Element collision between 768px and 1000px.
RLF 2 - ELEMENT PROTRUSION
BugMeNot: find and share logins

Enter a website below to see if the bugmenot community has shared any logins for it...

Domain/URL:
BugMeNot: find and share logins

Enter a website below to see if the bugmenot community has shared any logins for it...
1. Check whether any pair of elements are overlapping at any point.

2. If two elements are overlapping, check the layout at the wider viewport width.

3. If one element now contains the other, report an element protrusion failure.
RLF 2 - ELEMENT PROTRUSION

BugMeNot: find and share logins

Enter a website below to see if the bugmenot community has shared any logins for it...

Domain/URL:

320px-640px, overlapping
641px-1400px, contains

320px-1400px
HEADER

320px-1400px
FORM
RLF 2 - ELEMENT PROTRUSION

1. Check whether any pair of elements are overlapping at any point.

2. If two elements are overlapping, check the layout at the wider viewport width.

3. If one element now contains the other, report an element protrusion failure.
RLF 2 - ELEMENT PROTRUSION

Element protrusion between 320px and 640px.
RLF 3 – VIEWPORT PROTRUSION
Learn a language for free. Forever.

Get started

The best new way to learn a language.

Learning with Duolingo is fun and addictive. Earn points for correct answers, race against the clock, and level up. Our bite-sized lessons are effective, and we have proof that it works.

See how we do it

Gamification poured into every lesson.
Duolingo is the best new way to learn a language.

Language learning with Duolingo is fun and addictive. Earn points for correct answers, race against the clock, and level up. Our bite-sized lessons are effective, and there's proof that it works.
RLF 3 - VIEWPORT PROTRUSION

1. Look through each element.

2. Check that for every viewport width the element is visible, it is contained within some other element.

3. If, at any point, the element is not contained at all, report a viewport protrusion failure.
RLF 3 - VIEWPORT PROTRUSION

320PX-1400PX BODY

1050px-1400px, contains

981PX-1400PX DIV
RLF 3 – VIEWPORT PROTRUSION

1. Look through each element.

2. Check that for every viewport width the element is visible, it is contained within some other element.

3. If, at any point, the element is not contained at all, report a viewport protrusion failure.
RLF 3 - VIEWPORT PROTRUSION

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See how we do it

320px-1400px
BODY

1050px-1400px, contains

981px-1400px
DIV
RLF 3 - VIEWPORT PROTRUSION

1. Look through each element.

2. Check that for every viewport width the element is visible, it is contained within some other element.

3. If, at any point, the element is not contained at all, report a viewport protrusion failure.
Viewport protrusion between 981px and 1049px.
RLF 4 - SMALL-RANGE LAYOUTS

![Image of CloudConvert website](image-url)

- **214 formats supported**: CloudConvert supports the conversion between more than 200 different audio, video, document, ebook, archive, image, spreadsheet and presentation formats. Check the supported formats for more details.
- **file conversion in the cloud**: There is no need to install any software on your computer! Upload your files to CloudConvert and we will do the job for you. Don't worry, your files are safe and only you can access them. They will be deleted again as soon as your conversion is finished.
- **advanced features**: Most conversion types support advanced options, for example setting the codec of audio/video files. Also, we support batch converting and folder monitoring.
- **powerful API**: The CloudConvert API offers the full functionality of CloudConvert and makes it possible to use the conversion services in your own applications.

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AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
214 formats supported
CloudConvert supports the conversion between more than 200 different audio, video, document, ebook, archive, image, spreadsheet and presentation formats. Check the supported formats for more details.

file conversion in the cloud
There is no need to install any software on your computer! Upload your files to CloudConvert and we will do the job for you. Don’t worry, your files are safe and only you can access them. They will be deleted again as soon as your conversion is finished.

advanced features
Most conversion types support advanced options, for example setting the codecs of audio/video files. Also, we support batch converting and folder monitoring!

powerful API
The CloudConvert API offers the full functionality of CloudConvert and makes it possible to use the conversion services in your own applications.

We’ve converted 44,733,900 files with a total size of 604.81 TB.
1. Are any layouts only applied for a small number of viewport widths (e.g., 5)?

2. If so, check if similar layouts exist both before and after the small-range layout.

3. If so, report the small-range layout failure.
RLF 4 - SMALL-RANGE LAYOUTS

320px-1400px, above
980px-980px, overlapping
981px-1400px, above
RLF 4 - SMALL-RANGE LAYOUTS

1. Are any layouts only applied for a small number of viewport widths (e.g., 5)?

2. If so, check if similar layouts exist both before and after the small-range layout.

3. If so, report the small-range layout failure.
RLF 4 - SMALL-RANGE LAYOUTS

320px-1400px HEADER

320px-979px, above
980px-980px, overlapping
981px-1400px, above

320px-1400px BANNER
RLF 4 - SMALL-RANGE LAYOUTS

1. Are any layouts only applied for a small number of viewport widths (e.g., 5)?

2. If so, check if similar layouts exist both before and after the small-range layout.

3. If so, report the small-range layout failure.
RLF 4 - SMALL-RANGE LAYOUTS

Small-range layout at 980 pixels.

320px-979px, above
980px-980px, overlapping
981px-1400px, above
RLF 5 - ELEMENT WRAPPING

A Thoughtful Solution For Any Occasion
Send a custom greeting card to those special to you
We Send Cards On Your Behalf
Whether For A Friend Or A Client, We'll Send A Card Every Year

Get Started

A Thoughtful Solution For Any Occasion
Send a custom greeting card to those special to you
RLF 5 – ELEMENT WRAPPING

1. Analyse layout information to determine which elements are laid out in rows.

2. Are there any rows which one element is not in?

3. If this element is *in* the row at a wider viewport, report an element wrapping failure.
RLF 5 – ELEMENT WRAPPING

AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE

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RLF 5 – ELEMENT WRAPPING

1. Analyse layout information to determine which elements are laid out in rows.

2. Are there any rows which one element is not in?

3. If this element is *in* the row at a wider viewport, report an element wrapping failure.
RLF 5 – ELEMENT WRAPPING
RLF 5 – ELEMENT WRAPPING

1. Analyse layout information to determine which elements are laid out in rows.

2. Are there any rows which one element is not in?

3. If this element is in the row at a wider viewport, report an element wrapping failure.
Element wrapping between 768px and 800px.
EMPIRICAL EVALUATION

1. Can the approach detect responsive layout failures in real-world responsive web pages?

2. How effective are manual “spotchecking” approaches in comparison to our approach?

3. How long do our techniques take to run?

ReDeCheck - Responsive Design Checker
AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
RQ1

CAN THE APPROACH DETECT RESPONSIVE LAYOUT FAILURES IN REAL-WORLD RESPONSIVE WEB PAGES?
AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
22 MILLION
POCKET BY THE NUMBERS
2 BILLION
NUMBER OF ITEMS SAVED
RESEARCH QUESTION ONE

- Responsive layout failures found in 16 of the 26 web pages.
- 196 true positive results conflated to 33 distinct RLFs.
- False positives mainly caused by "coincidental" attributes being assigned to constraints.
- Many NOIs showed significant structural issues, which could easily manifest as TPs in the future.
- On average, developers need to check 4 distinct viewport ranges to observe each TP failure.

<table>
<thead>
<tr>
<th>Failure Type</th>
<th>TP</th>
<th>FP</th>
<th>NOI</th>
<th>RLFs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element Collision</td>
<td>8</td>
<td>0</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>Element Protrusion</td>
<td>3</td>
<td>0</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>Viewport Protrusion</td>
<td>24</td>
<td>0</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>Small-Range</td>
<td>152</td>
<td>43</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Wrapping</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>196</td>
<td>48</td>
<td>83</td>
<td>33</td>
</tr>
</tbody>
</table>
RQ2

HOW EFFECTIVE ARE MANUAL “SPOTCHECKING” APPROACHES IN COMPARISON TO OUR APPROACH?
RESEARCH QUESTION TWO

KERSLEY: 22
RESPONSITOR: 22
RD CHECKER: 23
V-RESIZER: 26
FIREFOX RWD: 27
REDECHECK: 33
RQ3

HOW LONG DO OUR TECHNIQUES TAKE TO RUN?
RESEARCH QUESTION THREE

AUTOMATED LAYOUT FAILURE DETECTION FOR RESPONSIVE WEB PAGES WITHOUT AN EXPLICIT ORACLE
THE REDECHECK TOOL

A tool for automatically detecting layout failures in modern responsive web pages. [Link to recheck.org]

Understanding the Failure Reports

The different failure types are highlighted in different ways to make them as easy to understand as possible. The following table will explain how to interpret the screenshots, followed by several examples:

<table>
<thead>
<tr>
<th>Failure Type</th>
<th>Interpretation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element Collusion</td>
<td>The two offending elements will be highlighted with red and blue boxes, respectively. In the example on the right, the panels numbered 1 and 2 are clearly shown to be overlapping.</td>
<td>[Screenshot from recheck.org]</td>
</tr>
<tr>
<td>Element Protrusion</td>
<td>The protruding element will be highlighted in blue with the ancestor it is currently overlapping with (highlighting the protrusion) highlighted in red. The example shows a set of &quot;invisible&quot; navigation links (blue) which have protruded outside of the header bar (red).</td>
<td>[Screenshot from recheck.org]</td>
</tr>
<tr>
<td>Viewport Protrusion</td>
<td>The viewport window will be highlighted in green, while the element protruding outside of the viewport will be highlighted in red. The example image shows a carousel bar (red) protruding outside of the viewport window (green).</td>
<td>[Screenshot from recheck.org]</td>
</tr>
</tbody>
</table>

[Link to more examples at GitHub]

[ Links: recheck.org, GitHub repository for redecheck, GitHub repository for example webpages]
THANK YOU

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REDECHECK.ORG