THOMAS WALSH[1], PHIL MCMINN[1], GREGORY KAPFHAMMER[2]

[1]UNIVERSITY OF SHEFFIELD, [2]ALLEGHENY COLLEGE

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

A LONG TIME AGO...

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

THE WEB TODAY

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

WHY SUPPORT ALL DEVICES?

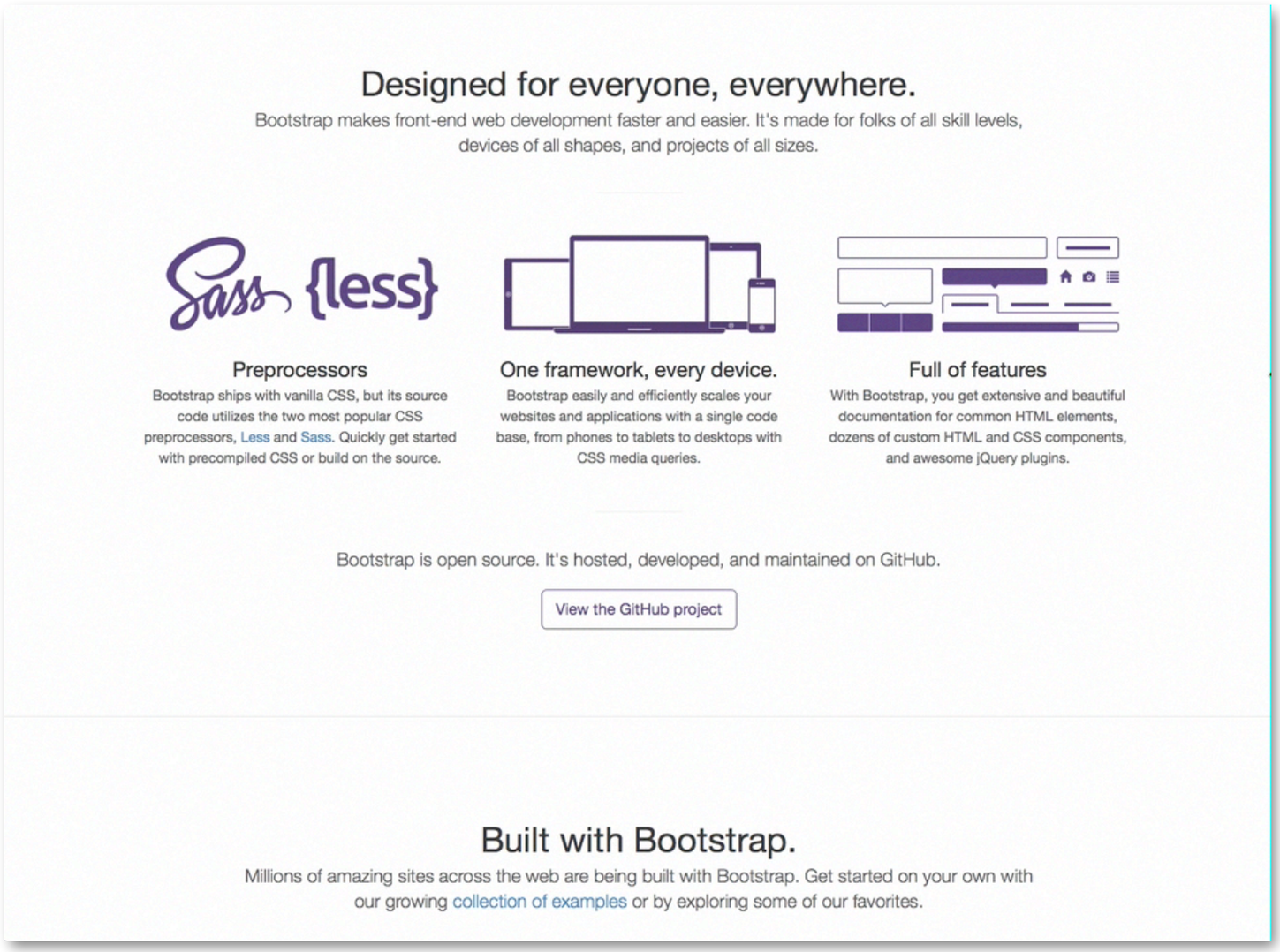
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

HOW CAN DEVELOPERS MAKE WEBSITES SUPPORT ALL DEVICES?

USE RESPONSIVE WEB DESIGN.

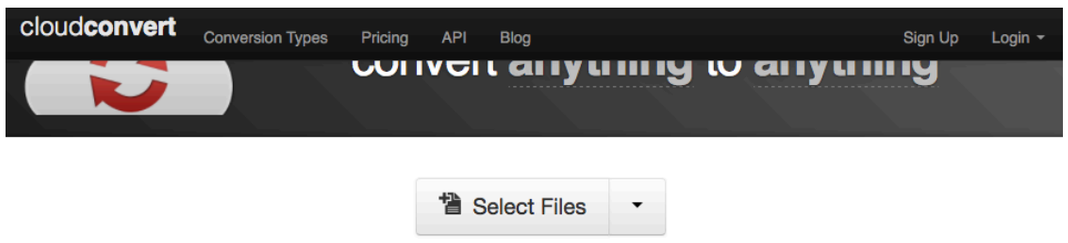
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RESPONSIVE WEB DESIGN



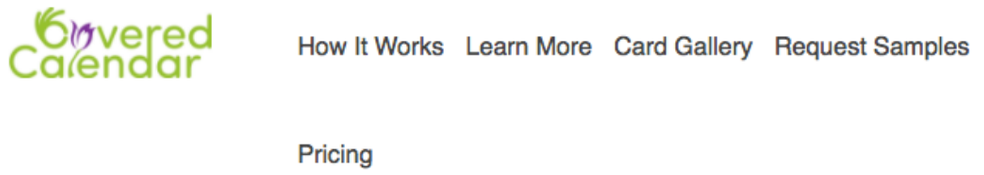
http://getbootstrap.com

RESPONSIVE LAYOUT FAILURES



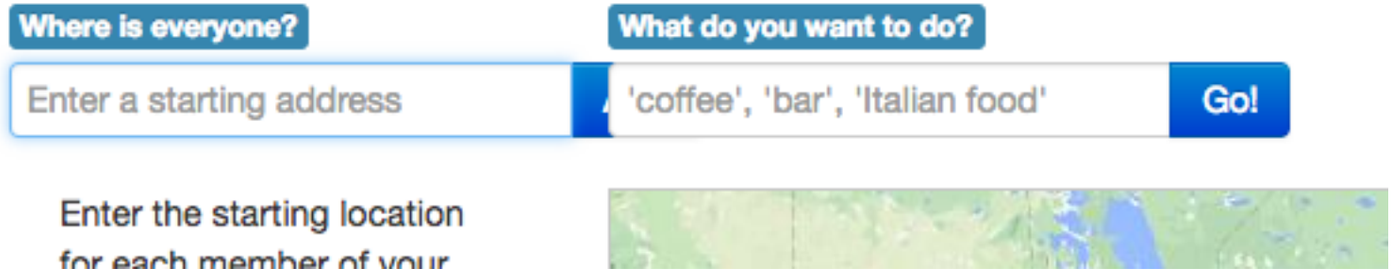
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RESPONSIVE LAYOUT FAILURES



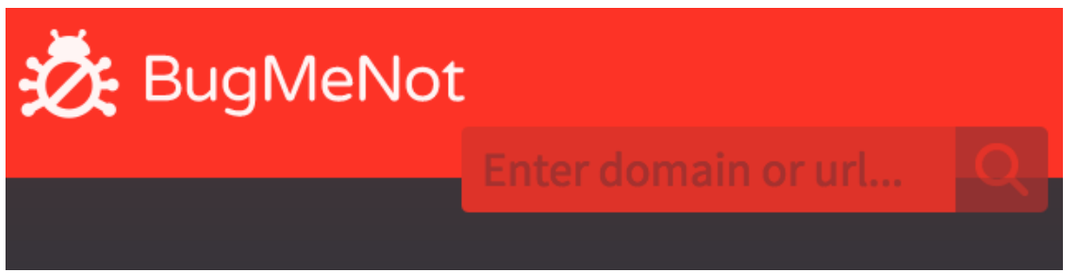
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RESPONSIVE LAYOUT FAILURES



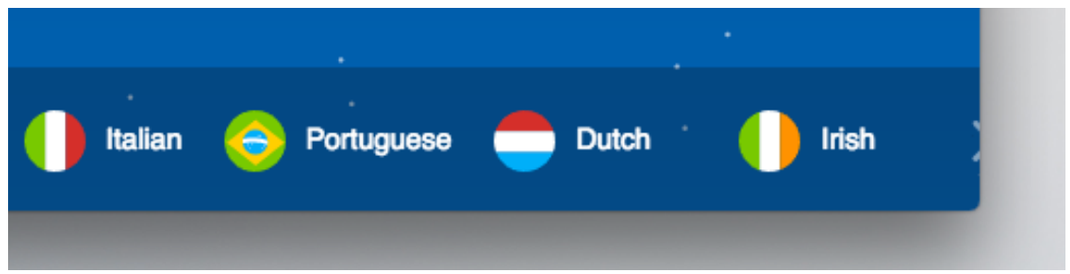
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RESPONSIVE LAYOUT FAILURES



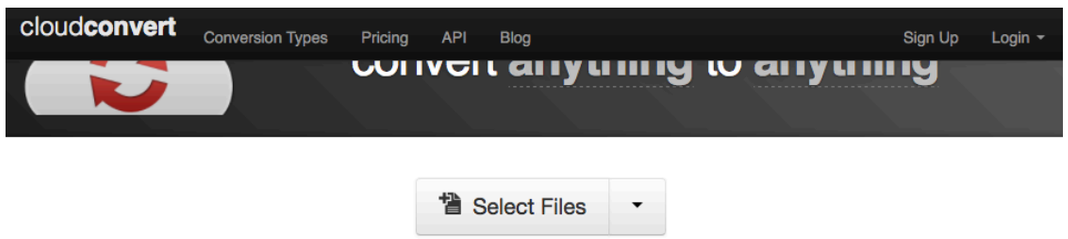
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

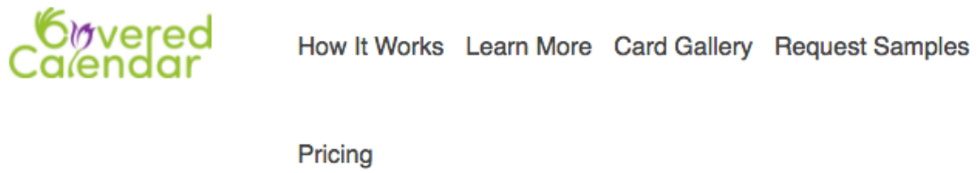
RESPONSIVE LAYOUT FAILURES

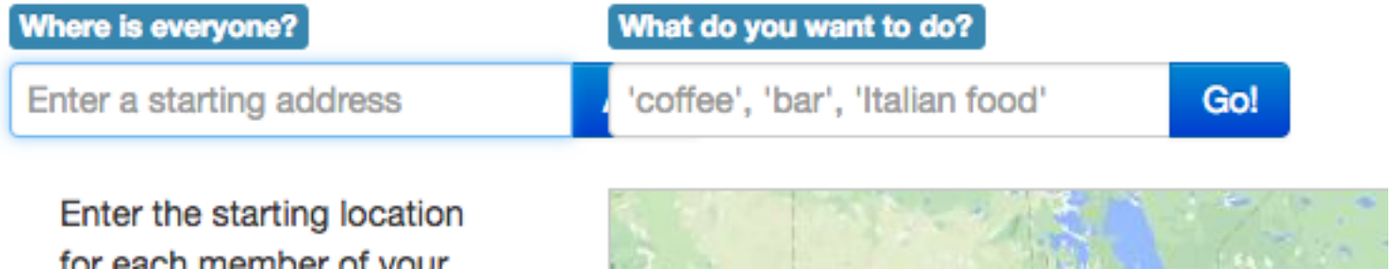


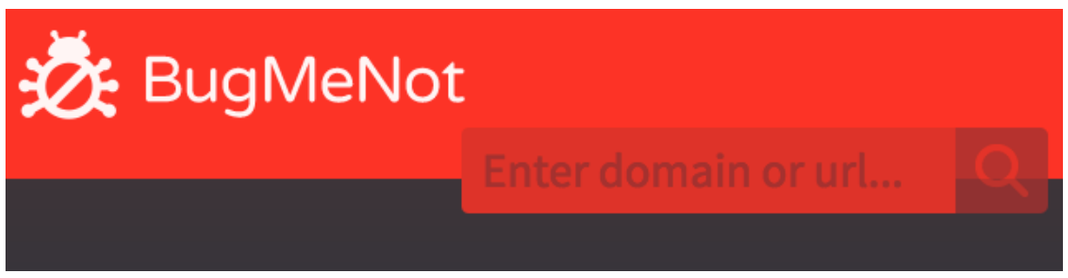
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

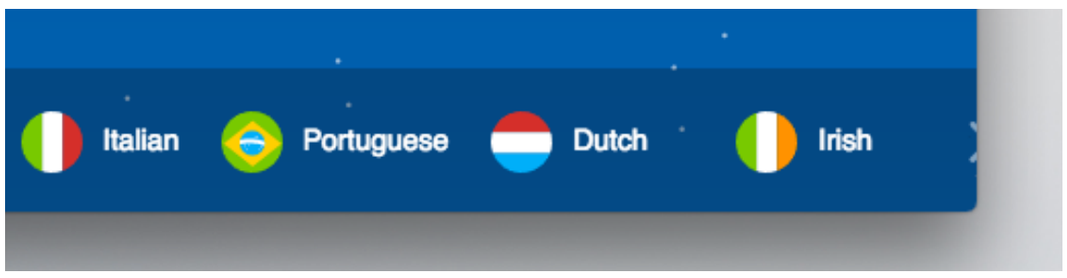
RESPONSIVE LAYOUT FAILURES











HOW DO DEVELOPERS TEST RESPONSIVE WEBSITES?

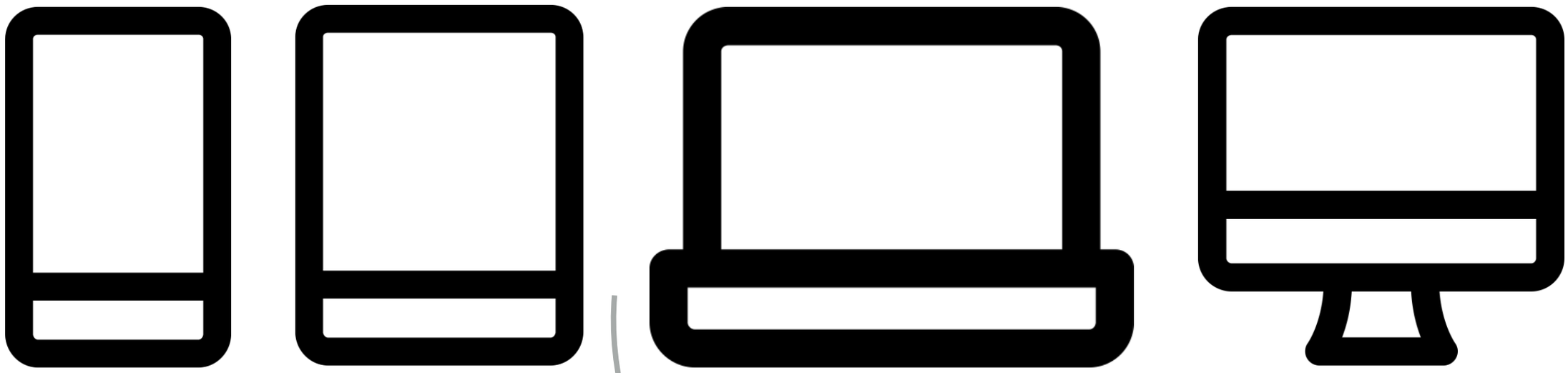
THEY "SPOT-CHECK".

WHAT IS THE ORACLE FOR RESPONSIVE WEBSITES?

THE HUMAN TESTER.

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

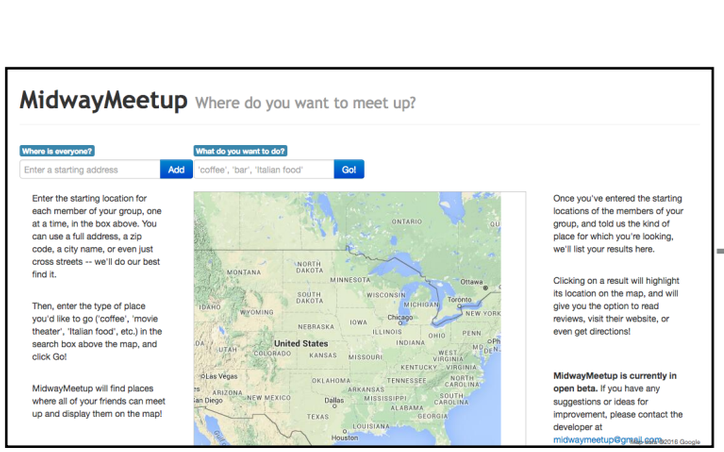
A SPOTCHECKING EXAMPLE



320 pixels 768 pixels 1024 pixels 1200 pixels

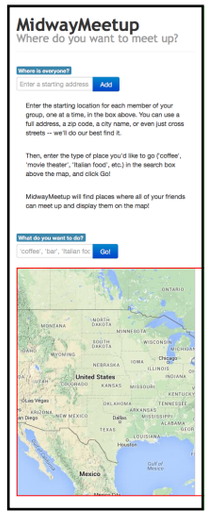
980 pixels

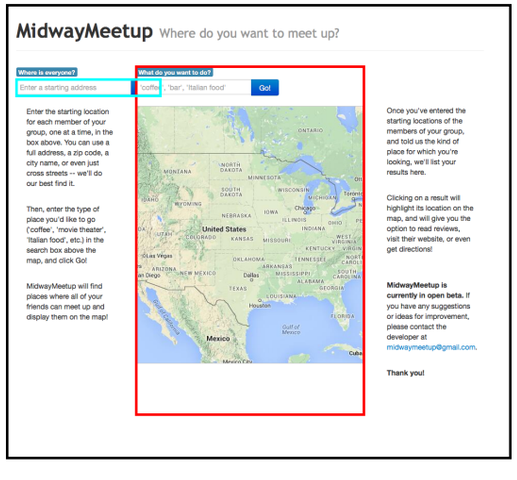
SUMMARY OF APPROACH



RESPONSIVE LAYOUT GRAPH (RLG)

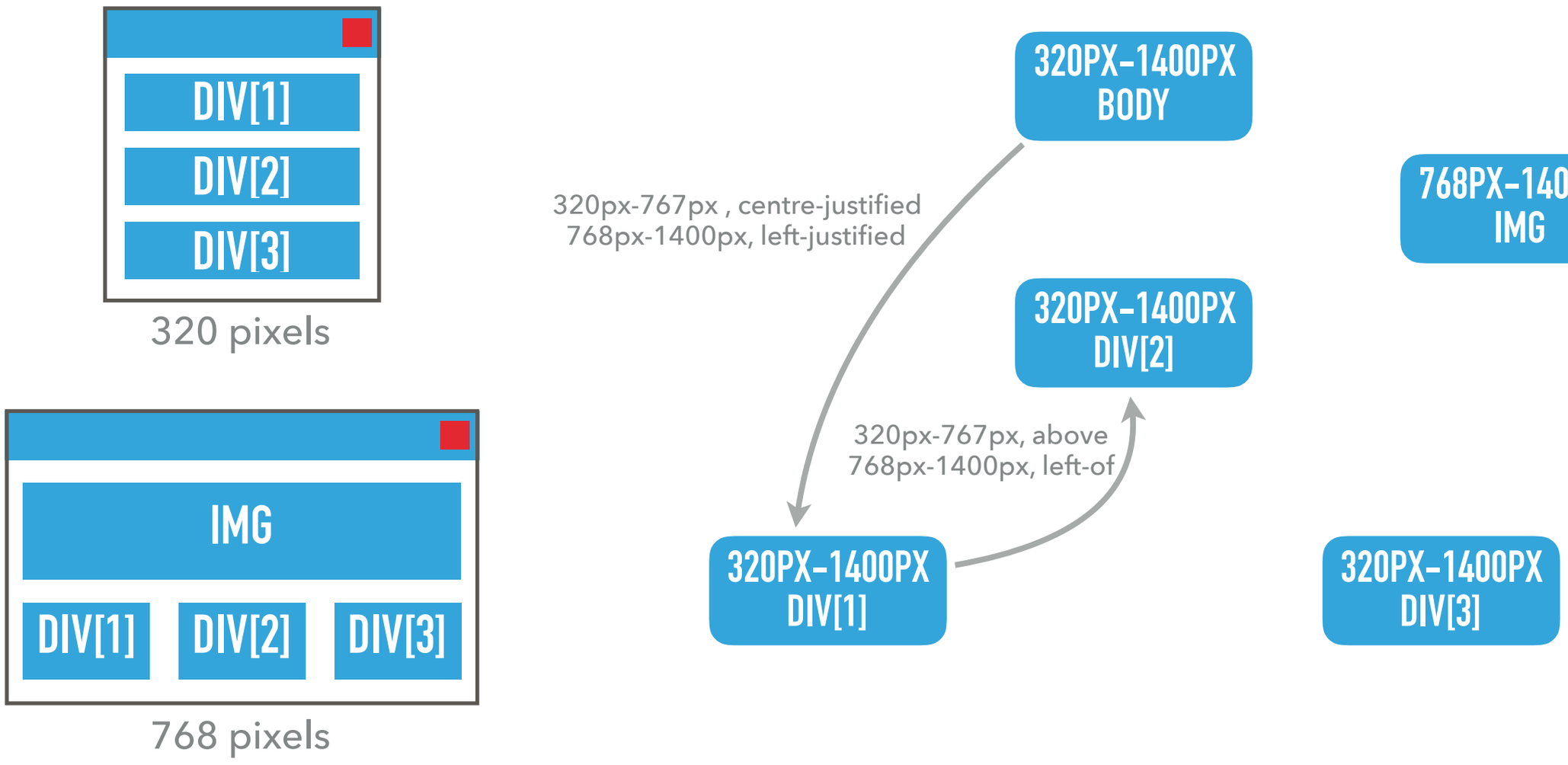
COMMON RESPONSIVE LAYOUT FAILURE DETECTION





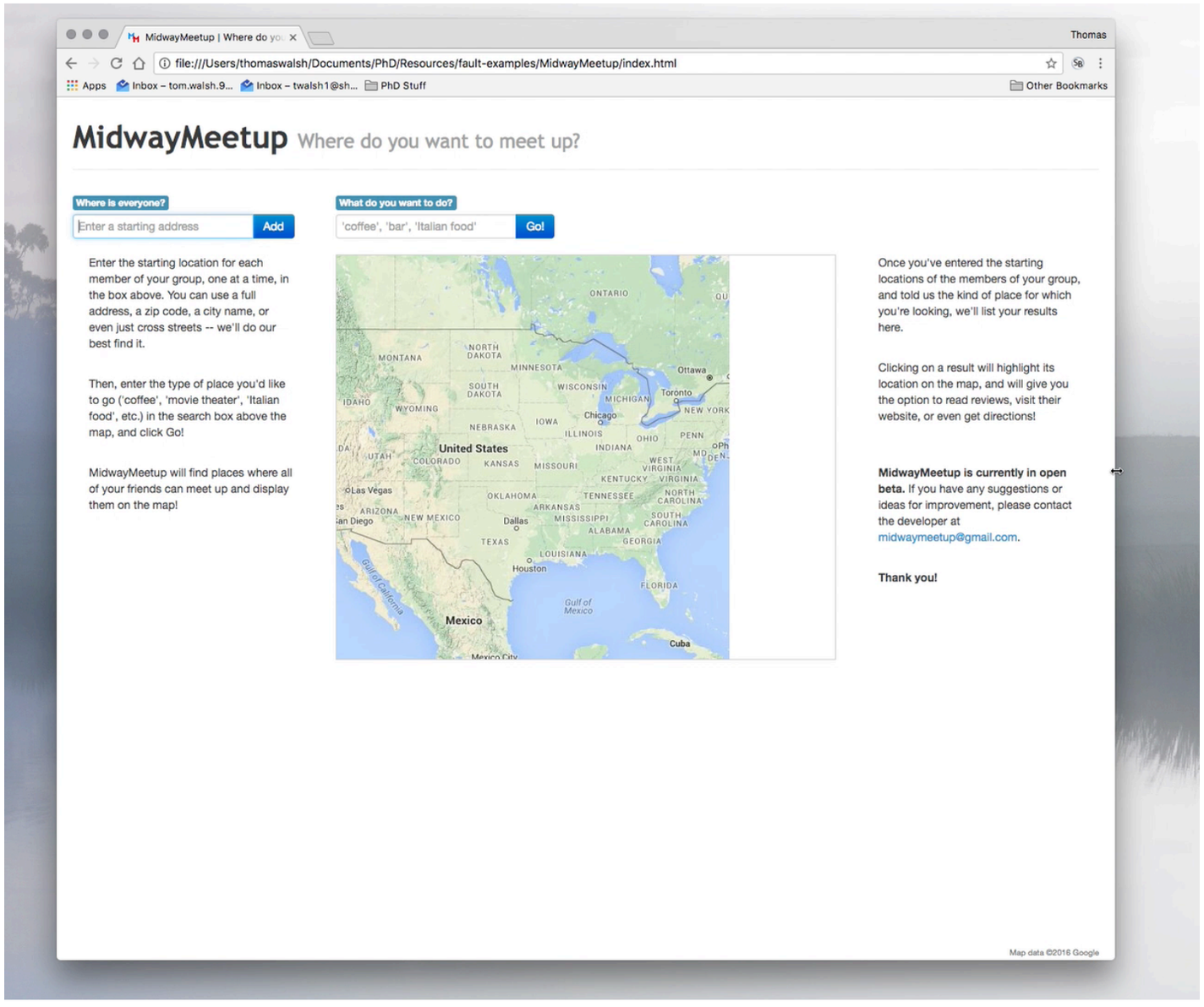
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

THE RESPONSIVE LAYOUT GRAPH



THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RLF 1 – ELEMENT COLLISION



MidwayMeetup Where do you want to meet up?

Where is everyone?

Enter a starting address

What do you want to do?

'coffee', 'bar', 'Italian food'

Go!

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!

MidwayMeetup Where do you want to m

Where is everyone?

Enter a starting address

What do you want to do?

'coffee', 'bar', 'Italian food'

Go!

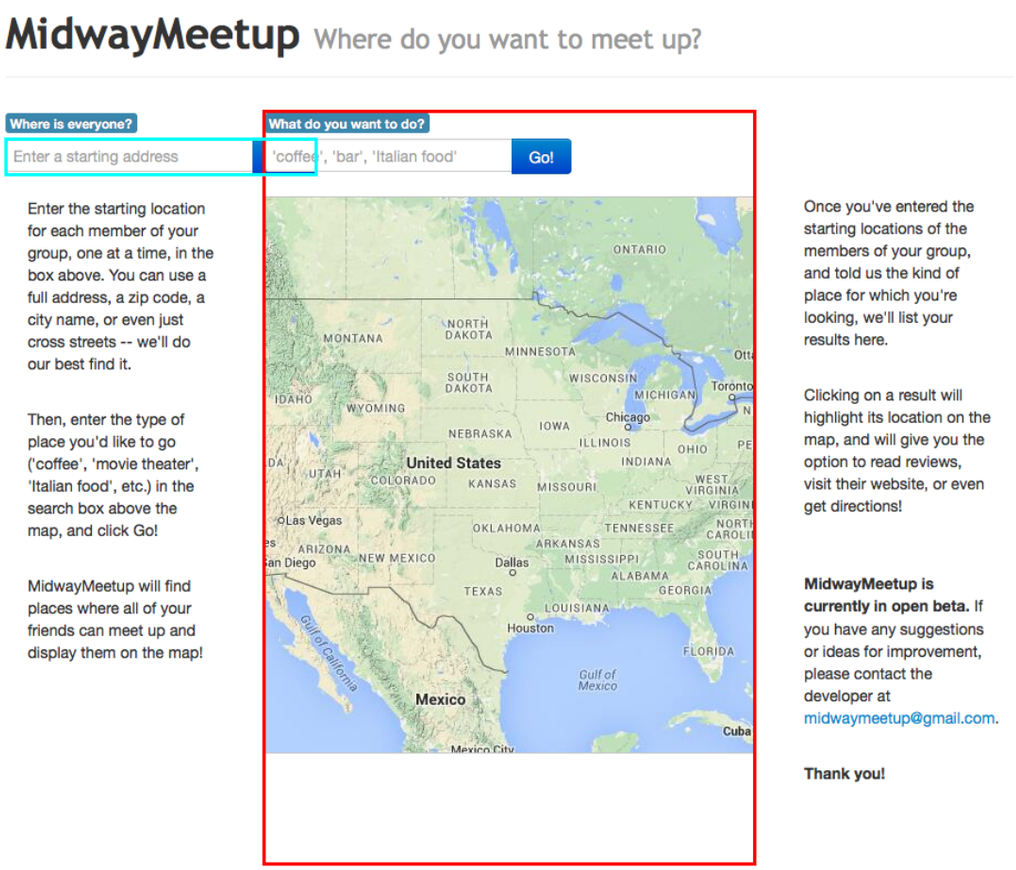
Enter the starting location for each member of your group, one at a time, in the box above. You can use a full address, a zip code, a city name, or even just cross streets -- we'll do our best find it.

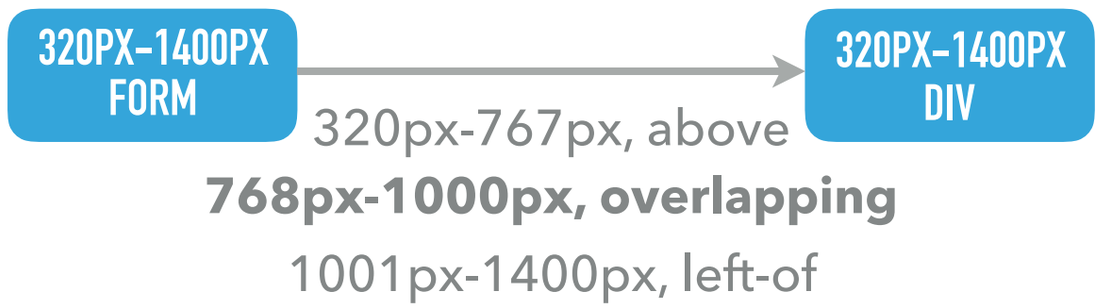
Then, enter the type of place you'd like to go

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.

RLF 1 – ELEMENT COLLISION



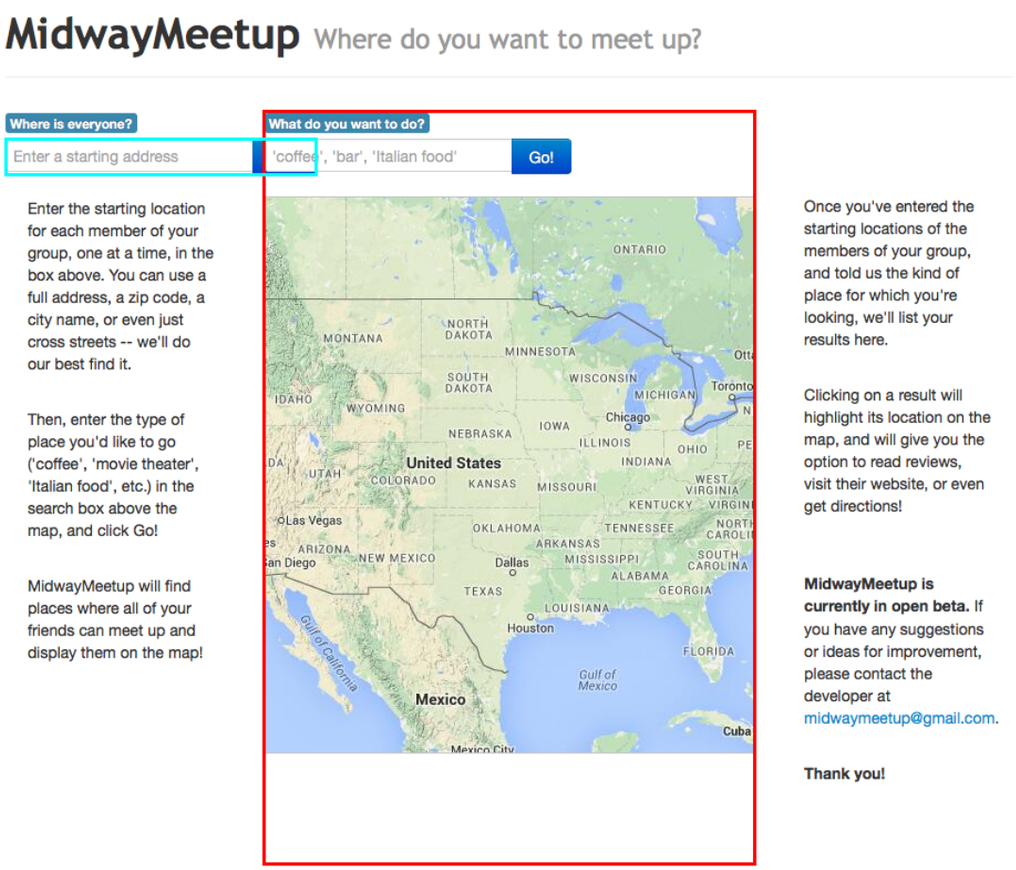


THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

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.

RLF 1 – ELEMENT COLLISION



320PX–1400PX FORM → 320PX–1400PX DIV

320px-767px, above

768px-1000px, overlapping

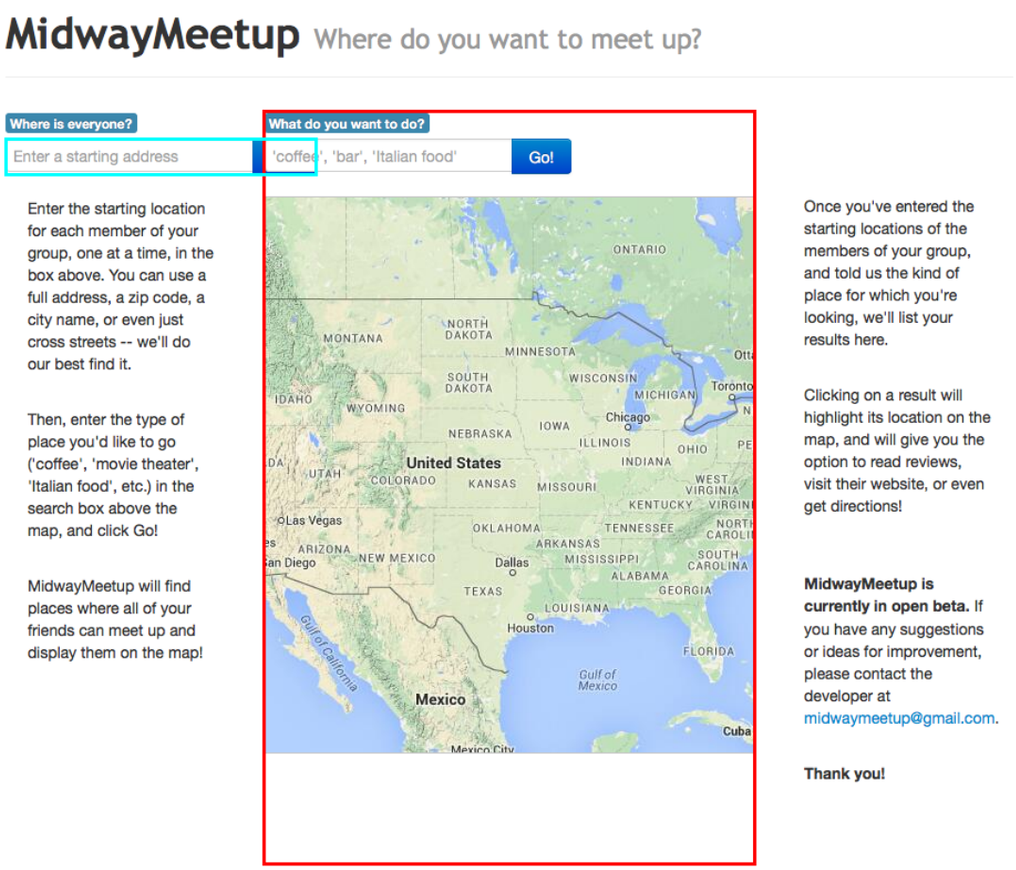
1001px-1400px, left-of

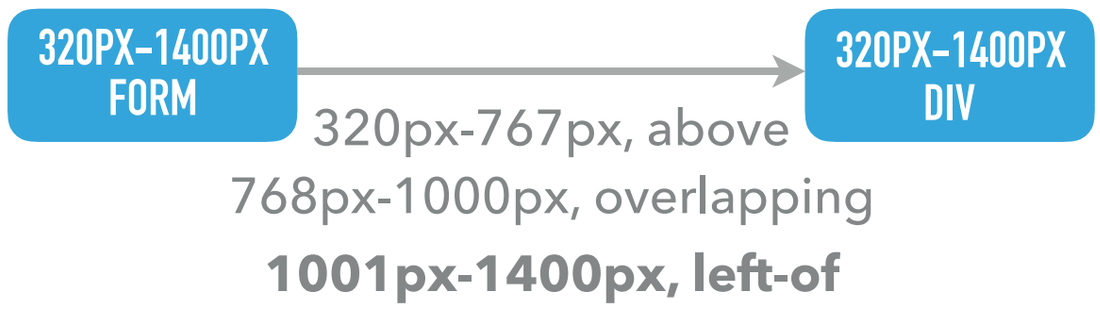
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

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.**

RLF 1 – ELEMENT COLLISION

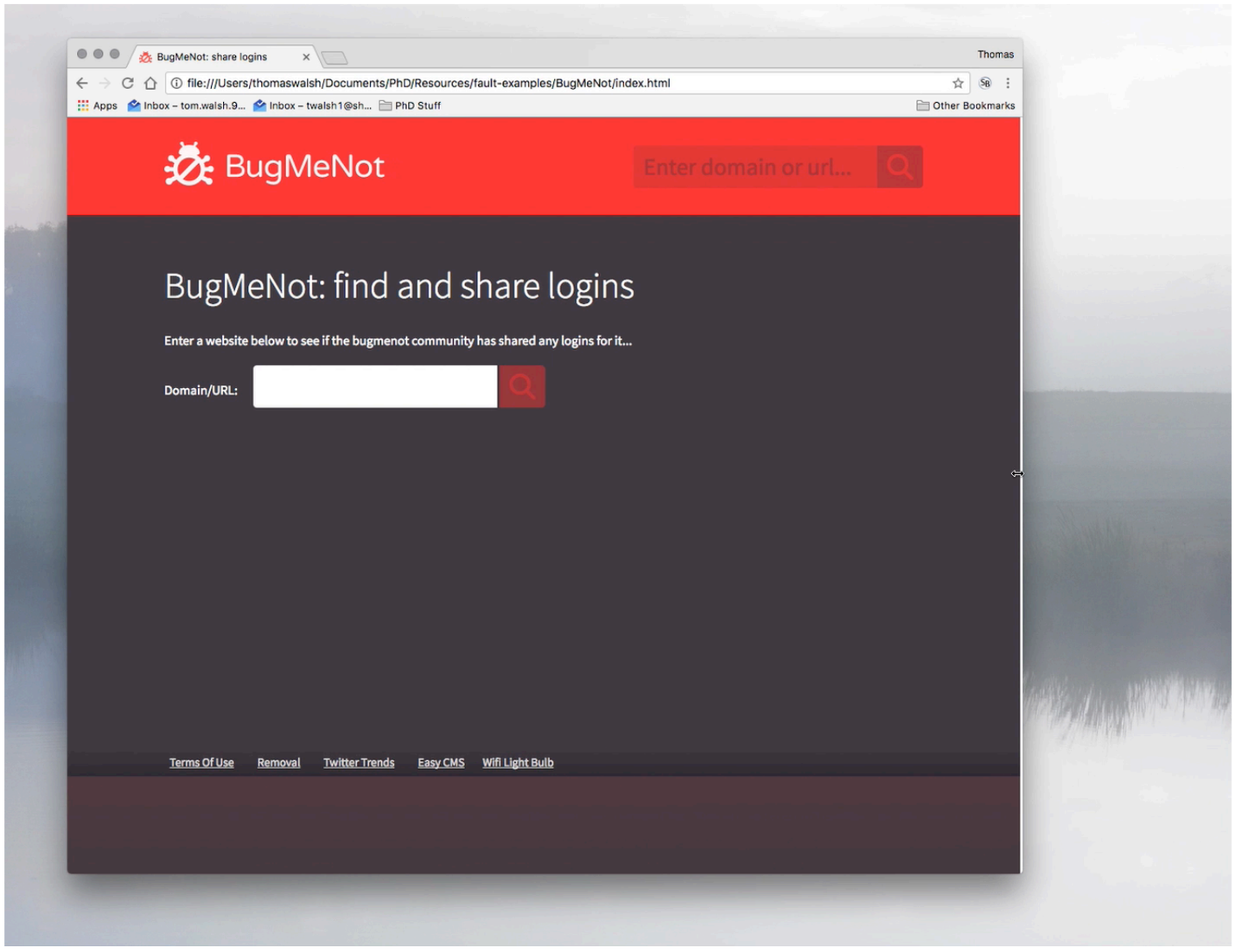




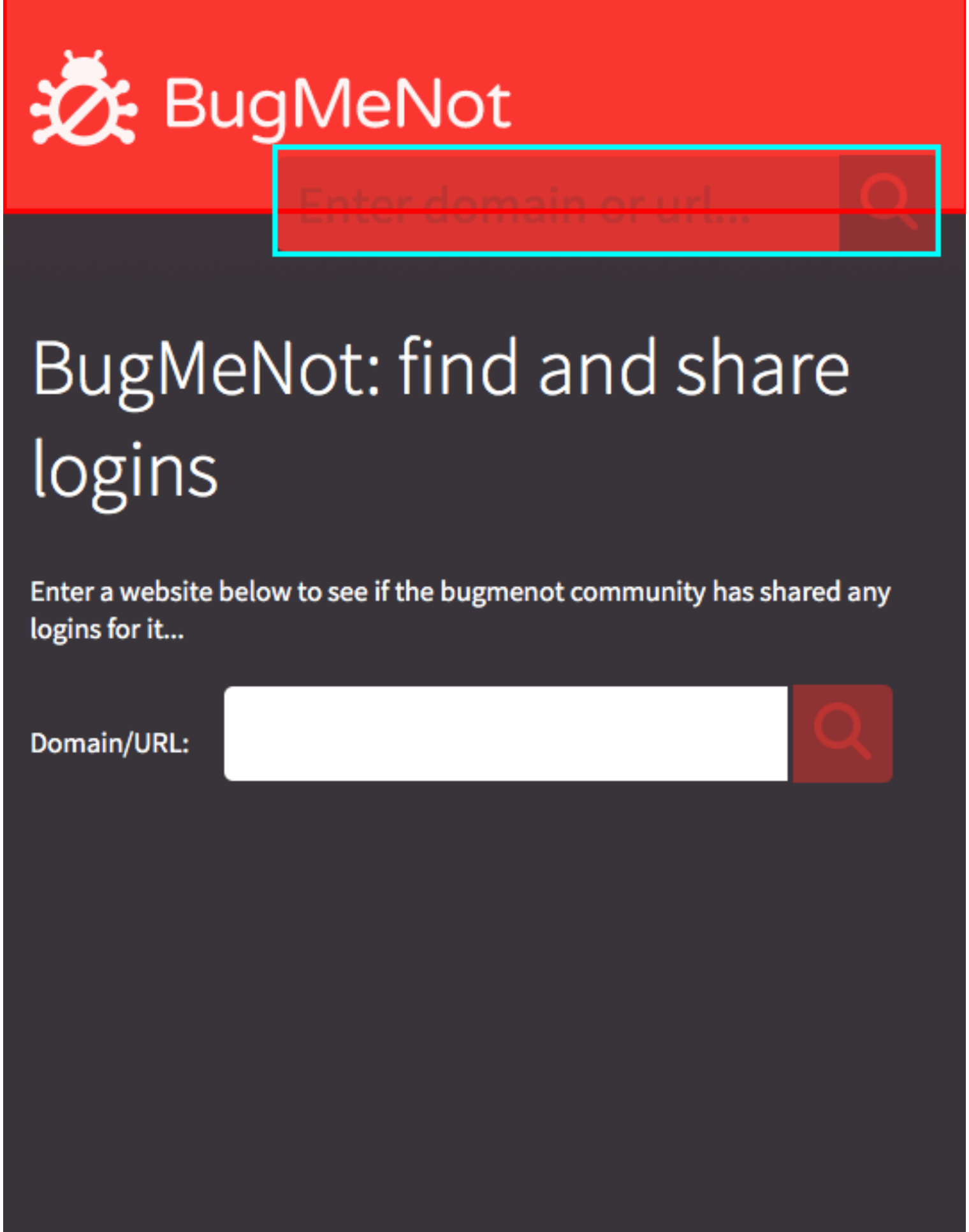
Element collision between 768px and 1000px.

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RLF 2 – ELEMENT PROTRUSION



THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK


BugMeNot
Enter domain or url...
BugMeNot: find and share logins
Enter a website below to see if the bugmenot community has shared any logins for it...
Domain/URL:

BugMeNot

Enter domain or url...

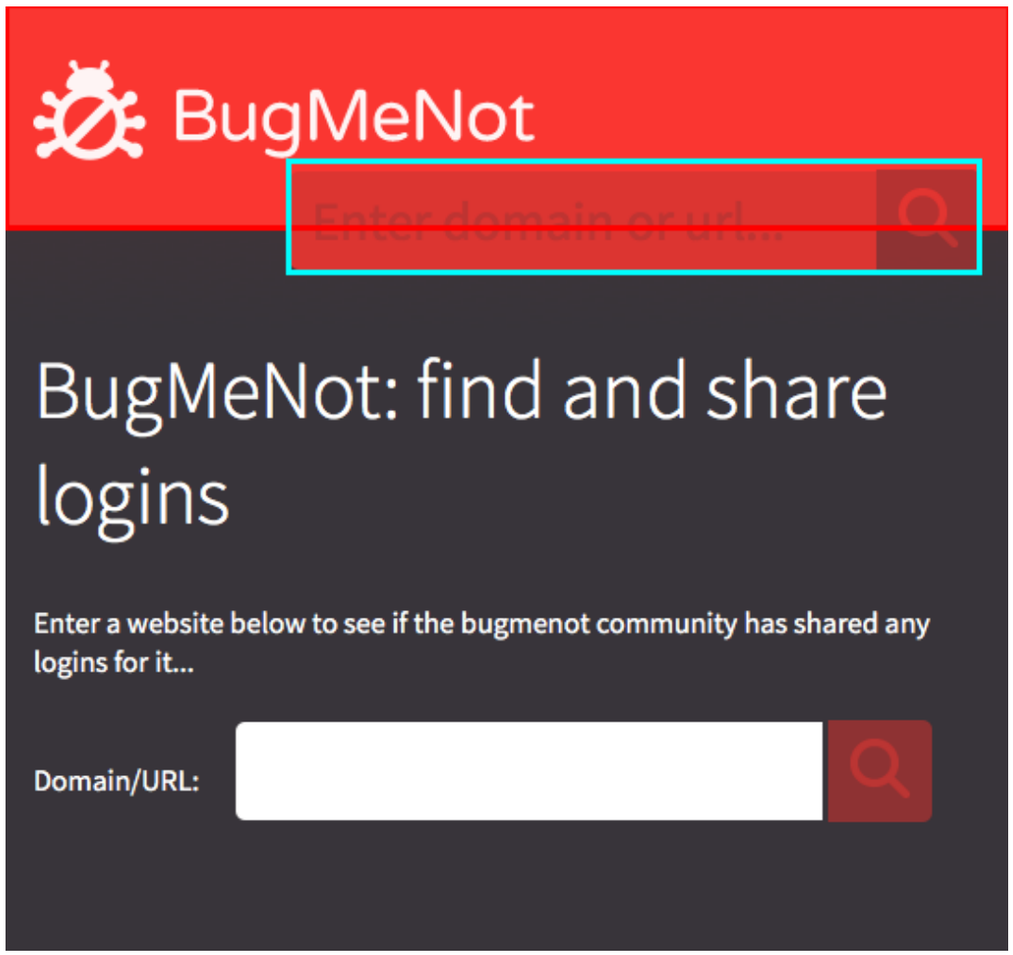
BugMeNot: find and share logins

nter a website below to see if the bugmenot community has shared any gins for it...

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.

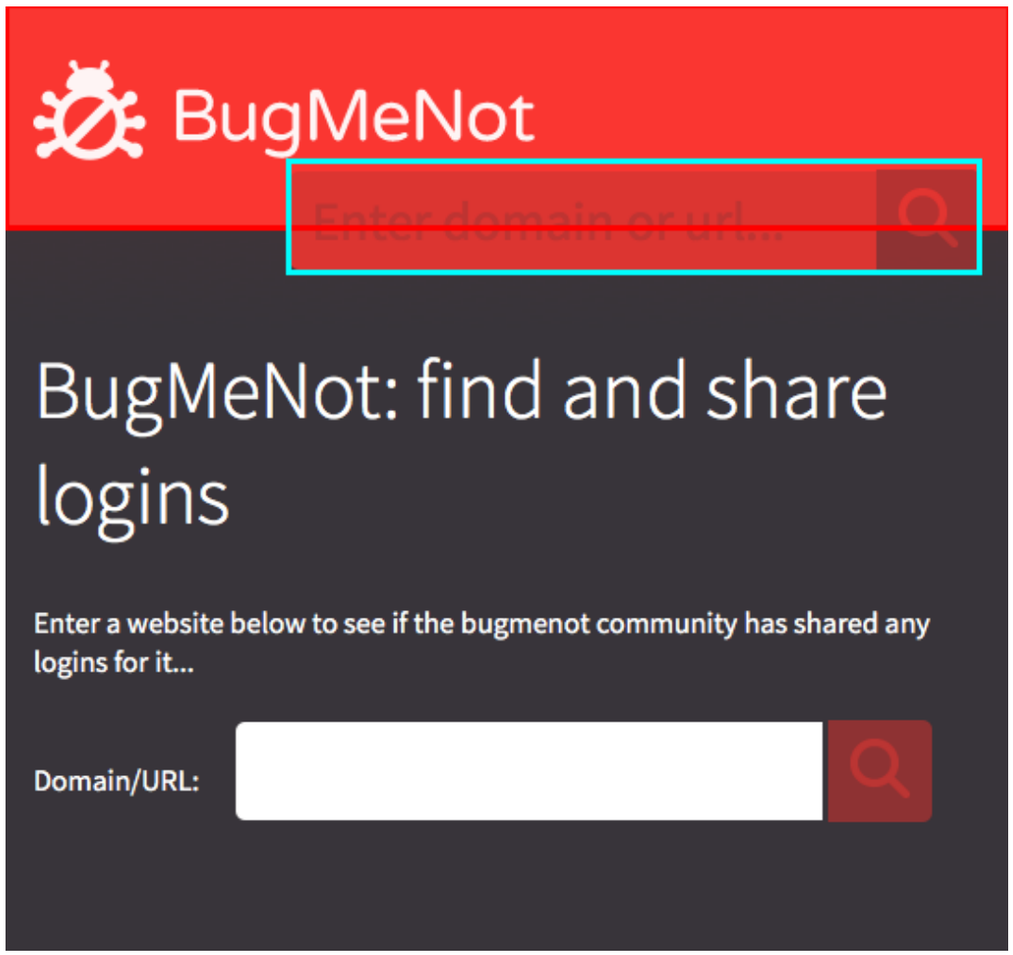
RLF 2 – ELEMENT PROTRUSION



RLF 2 – ELEMENT PROTRUSION

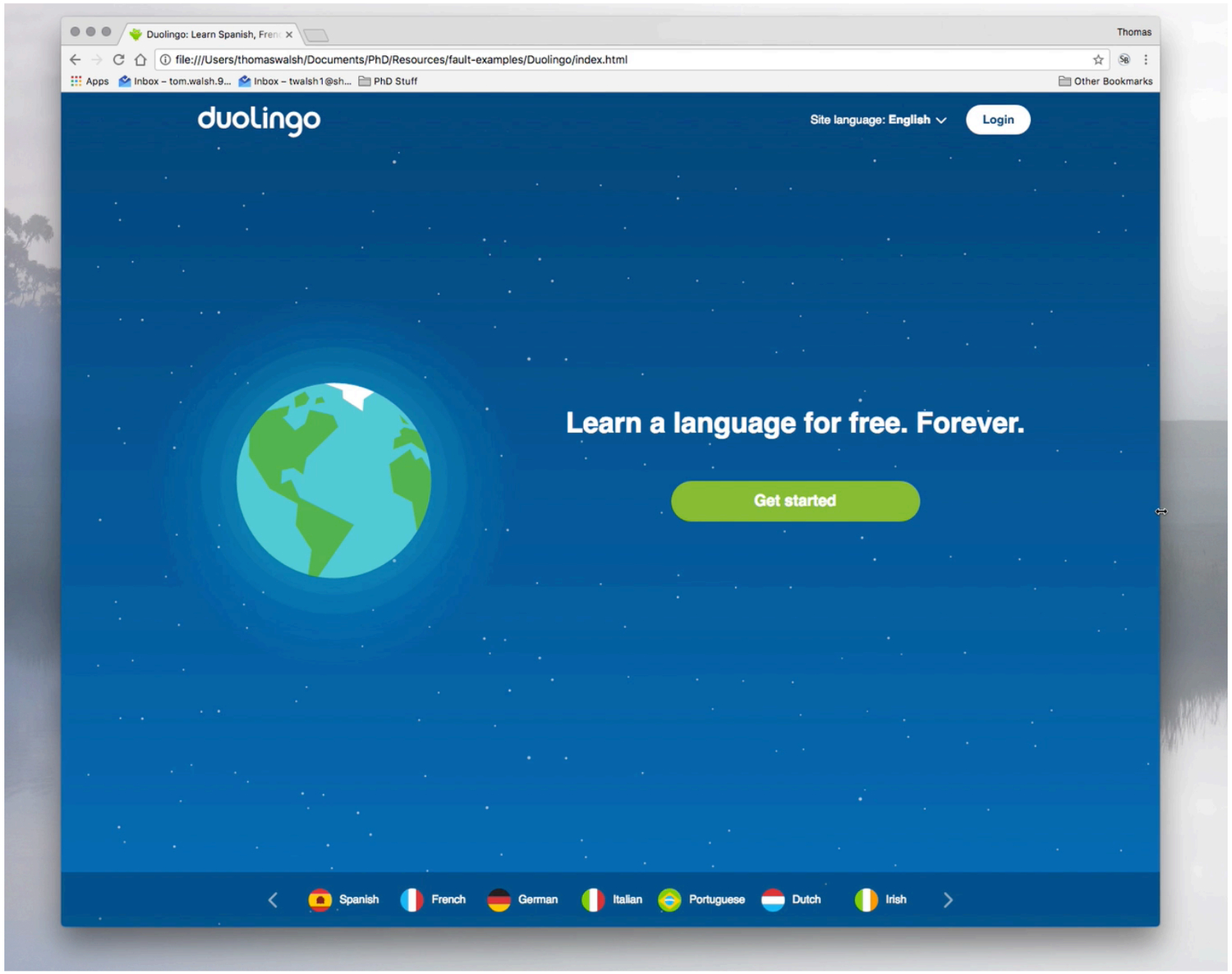
1. Check whether any pair of elements are overlapping at any point.
2. If two elements are overlapping, check the layout at the wider viewport width.
3. **If one element now contains the other, report an element protrusion failure.**

RLF 2 – ELEMENT PROTRUSION



Element protrusion between 320px and 640px.

RLF 3 – VIEWPORT PROTRUSION



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.

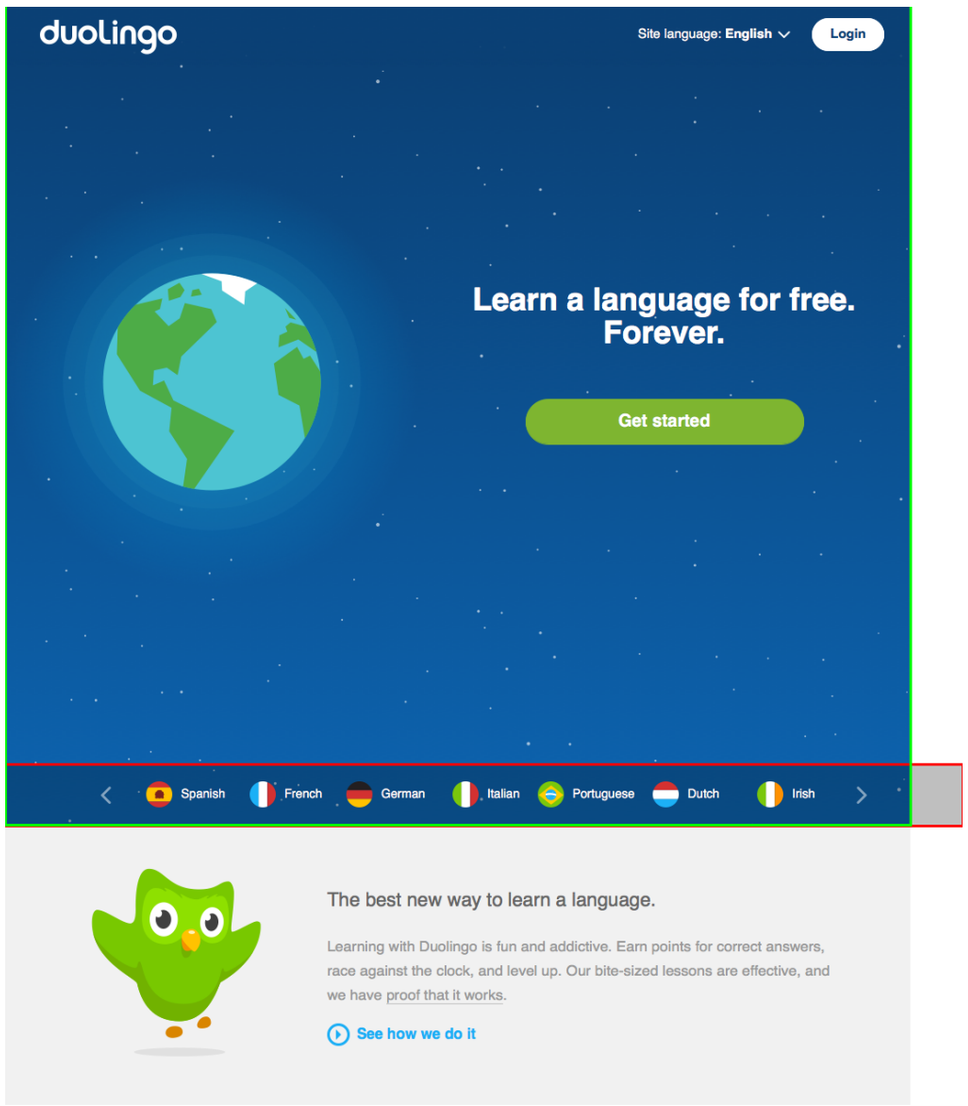
st new way to learn a language.

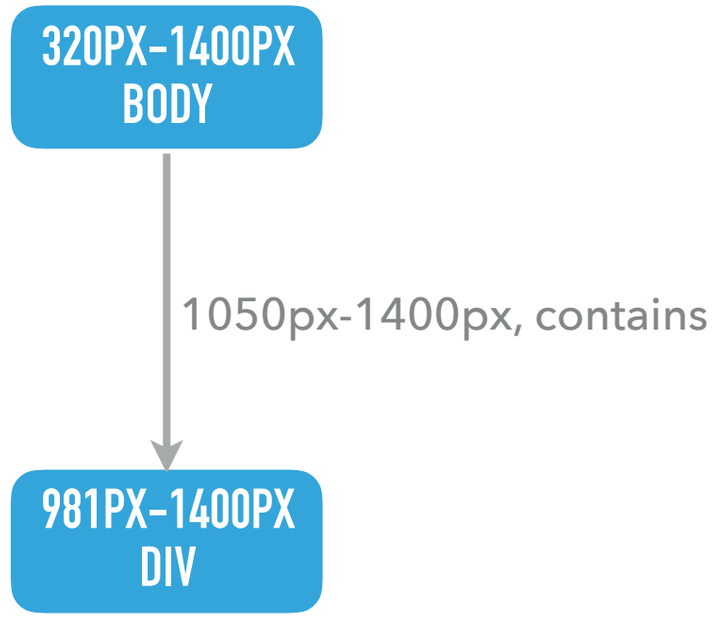
with Duolingo is fun and addictive. Earn points for correct answers,
inst the clock, and level up. Our bite-sized lessons are effective, and
proof that it works.

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

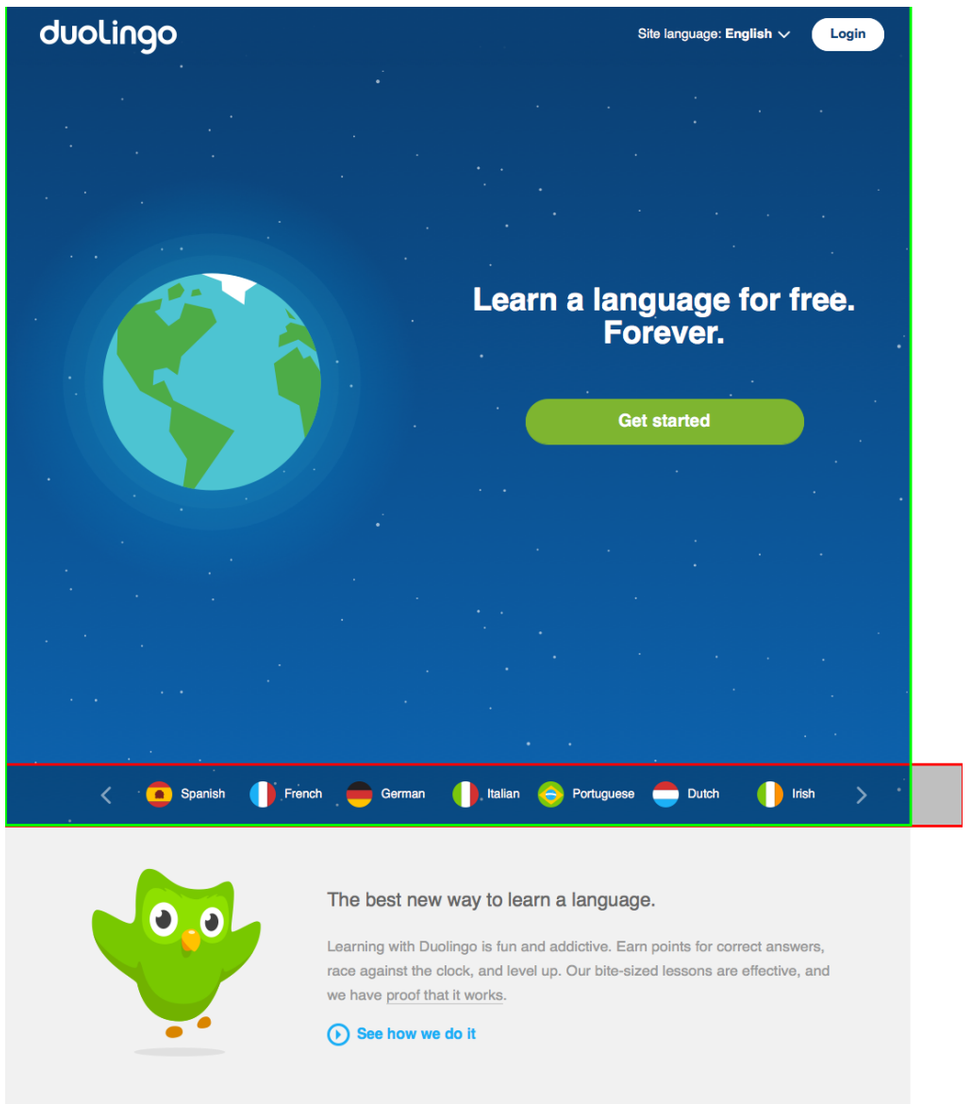


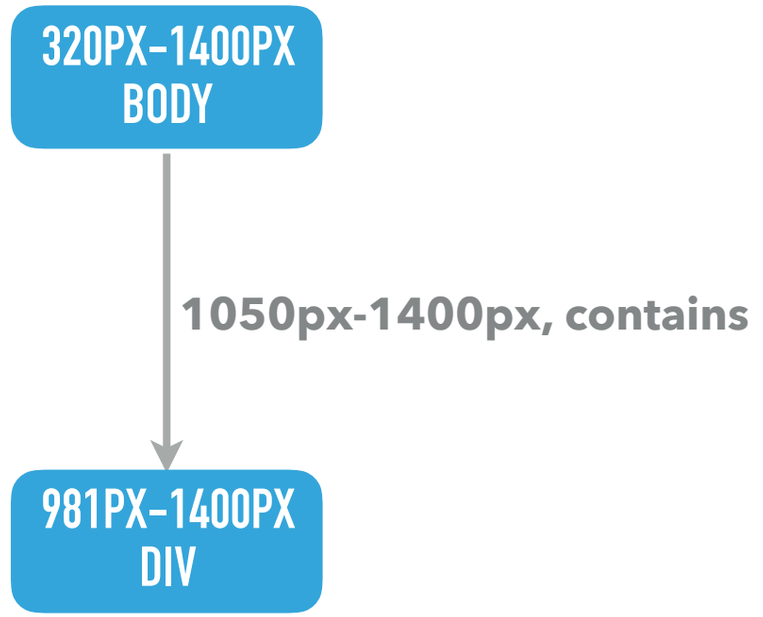


RLF 3 – VIEWPORT PROTRUSION

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

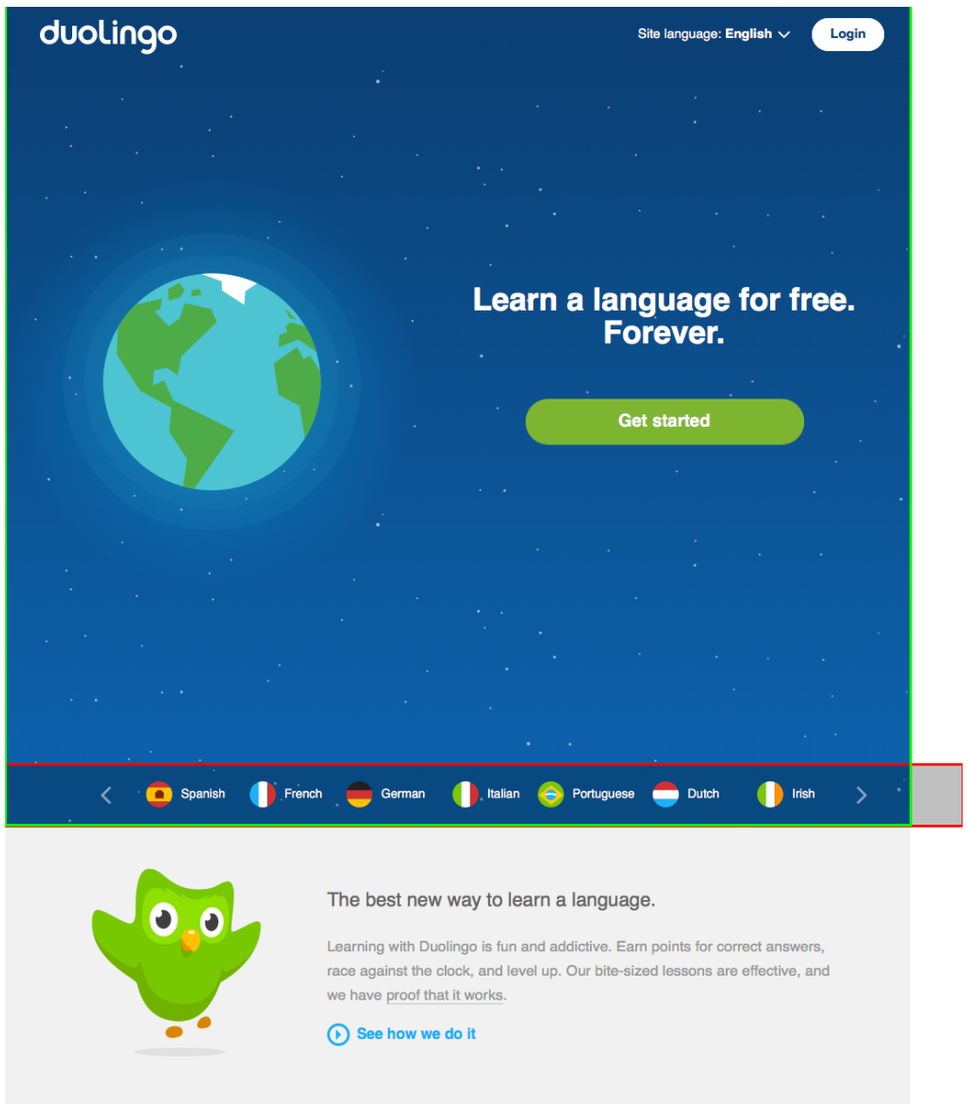


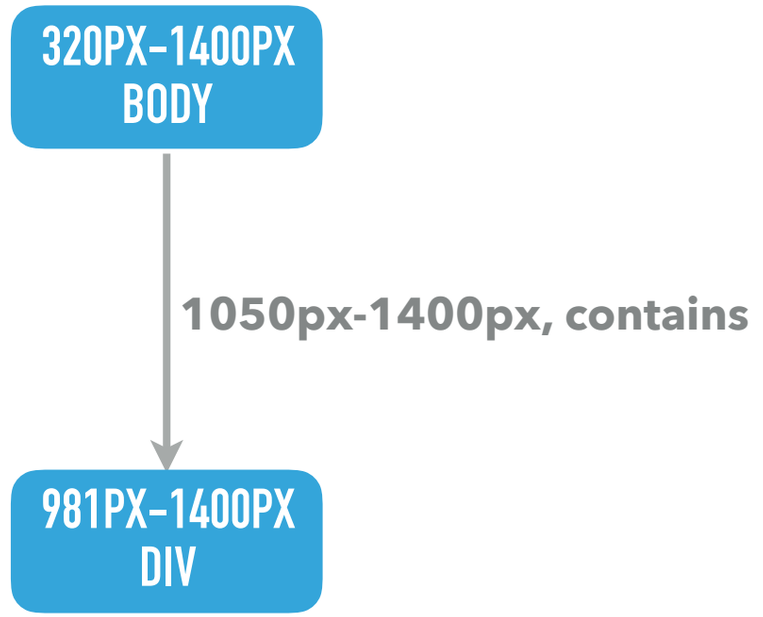


RLF 3 – VIEWPORT PROTRUSION

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.**

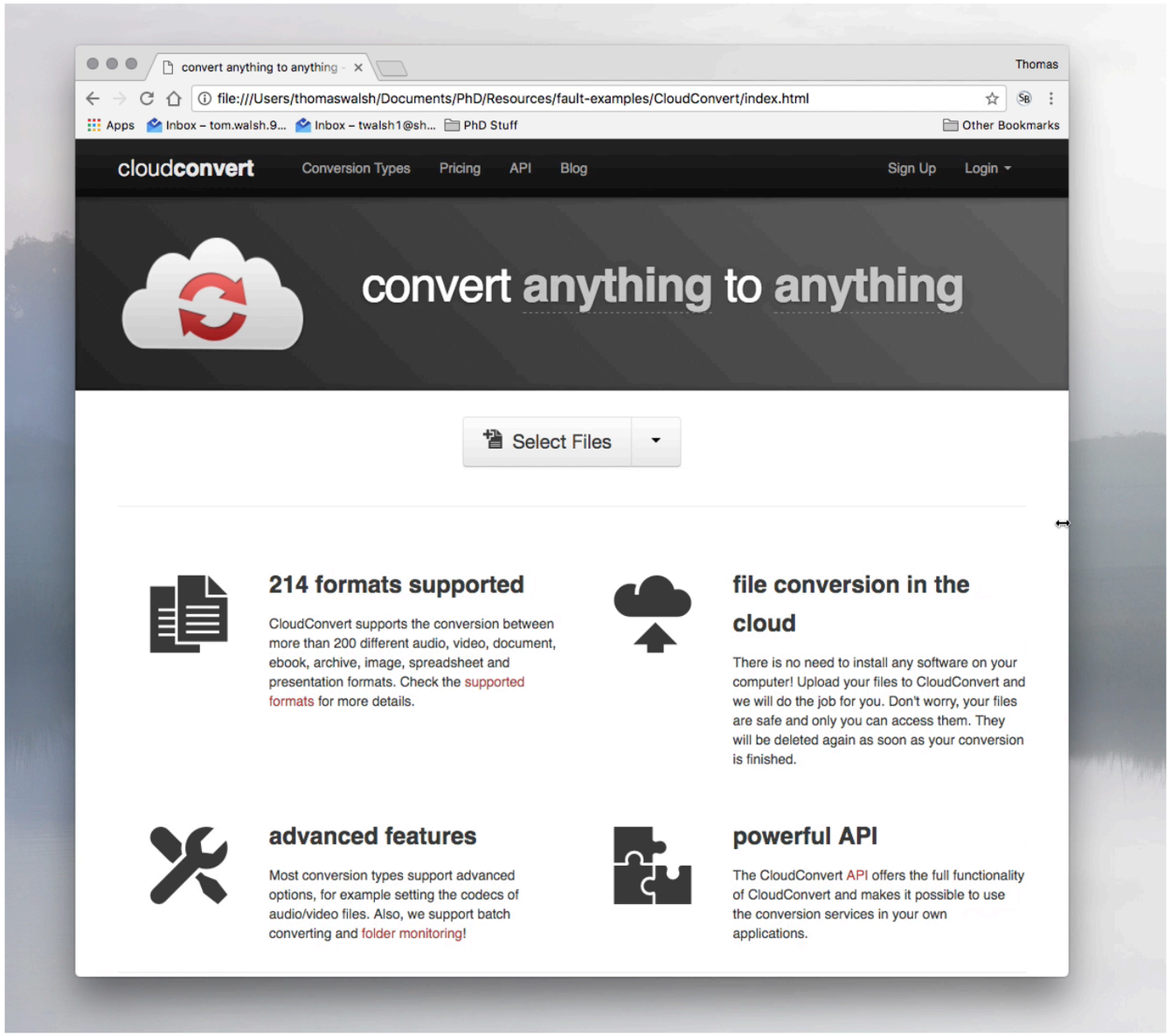
RLF 3 – VIEWPORT PROTRUSION





Viewport protrusion between 981px and 1049px.

RLF 4 – SMALL-RANGE LAYOUTS



cloudconvert Conversion Types Pricing API Blog Sign Up Login

convert anything to anything

Select Files

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!

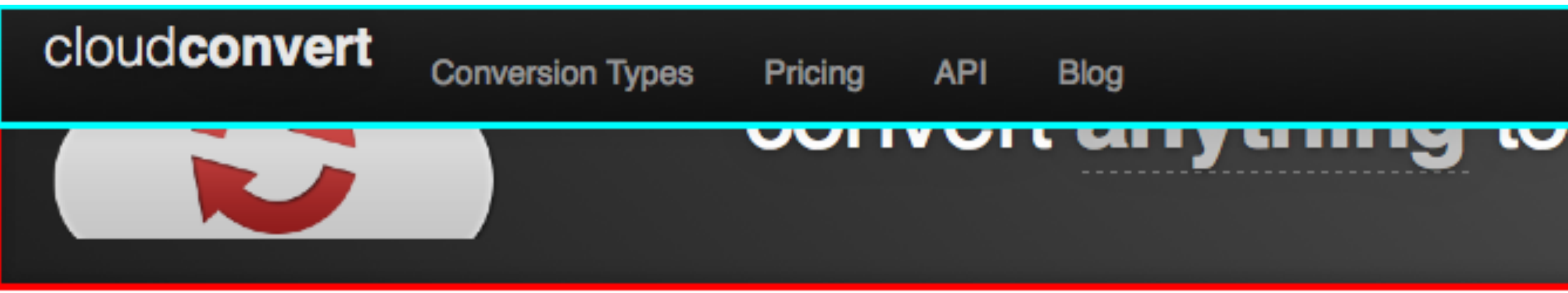
powerful API

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

Add to Chrome Get iOS App Tweet Follow @CloudConvert Like 19K

Contact Privacy Terms Status

We've converted **44,733,900 files** with a total size of **604.81 TB**.



Select Files

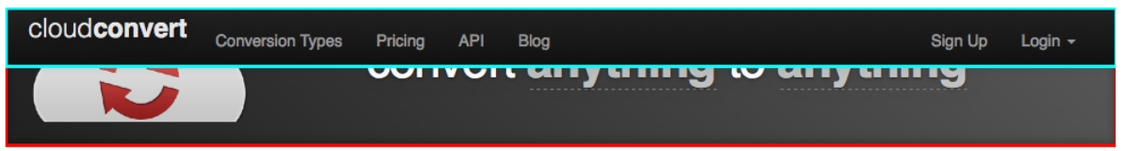
214 formats supported

fi

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-979px, above

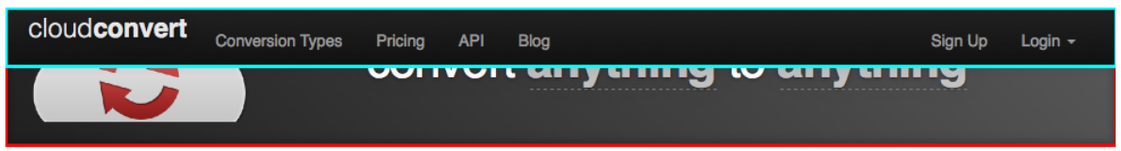
980px-980px, overlapping

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-979px, above

980px-980px, overlapping

981px-1400px, above

RLF 4 – SMALL-RANGE LAYOUTS

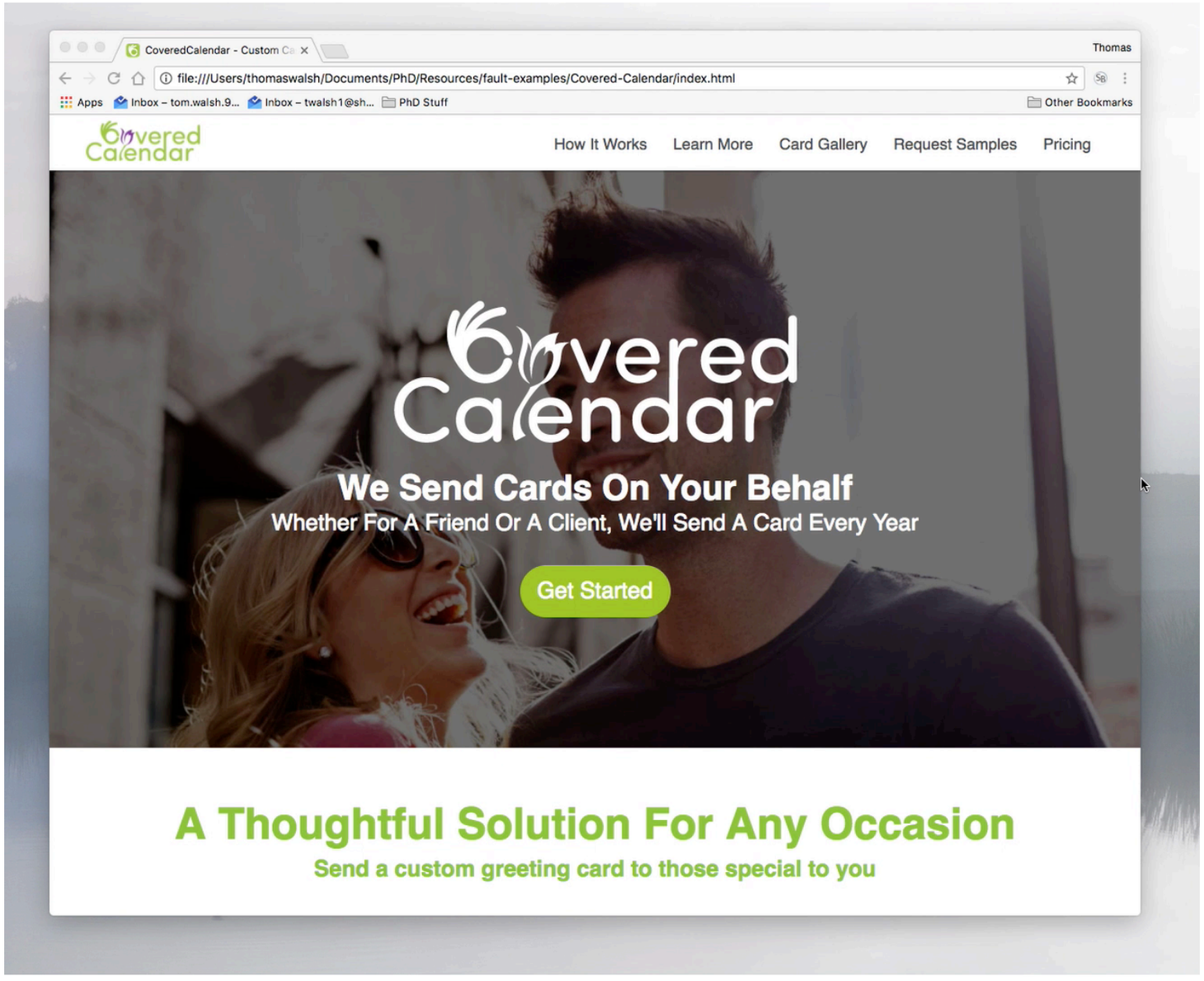
1. Are any layouts only applied for a *small number* of viewport widths (e.g., 5)?
2. If so, check if similar layouts exist both *before* and *after* the small-range layout.
3. **If so, report the small-range layout failure.**

RLF 4 – SMALL-RANGE LAYOUTS

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

Small-range layout at 980 pixels.

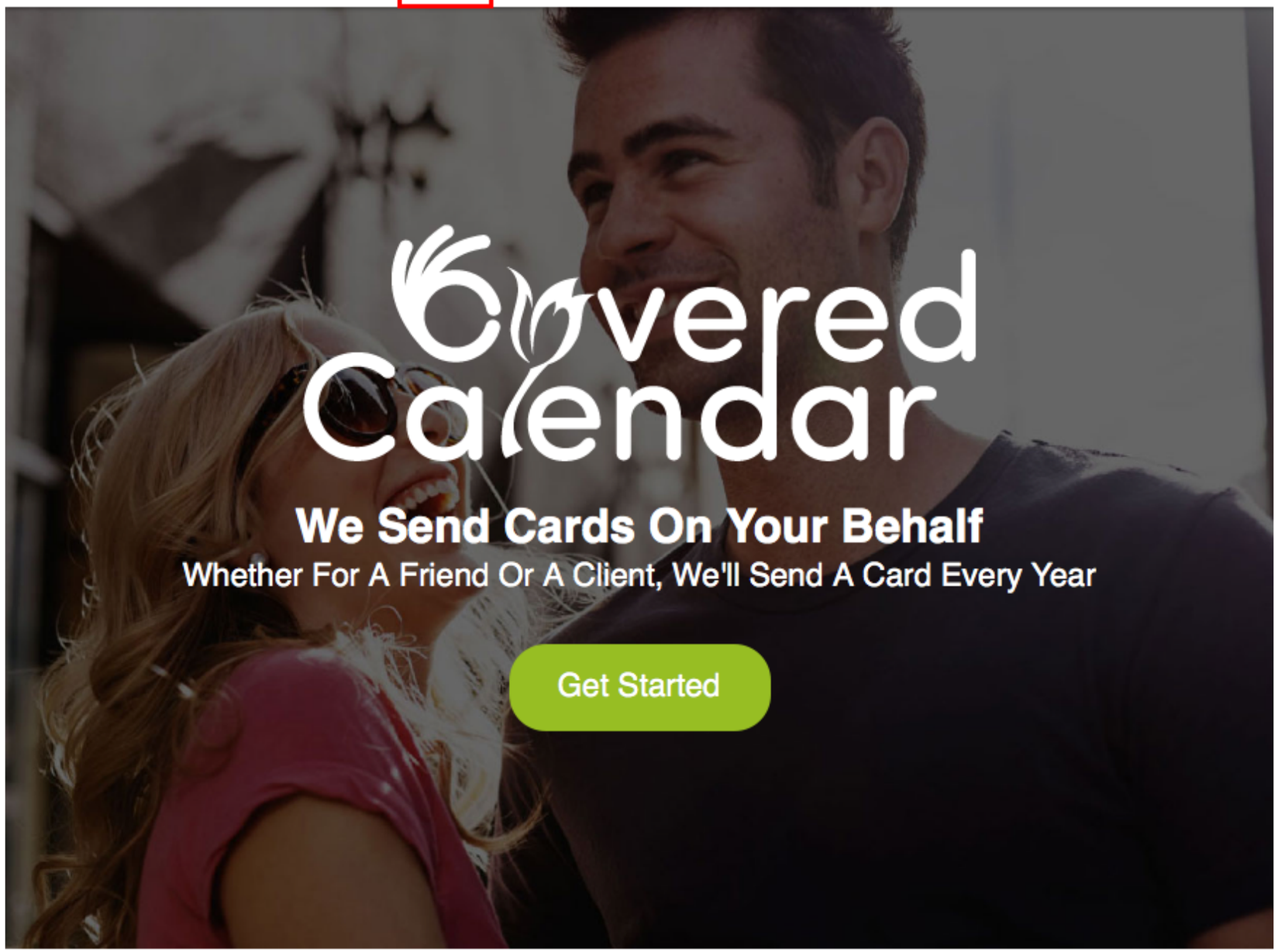
RLF 5 – ELEMENT WRAPPING



Covered Calendar

How It Works Learn More Card Gallery Request Samples

Pricing



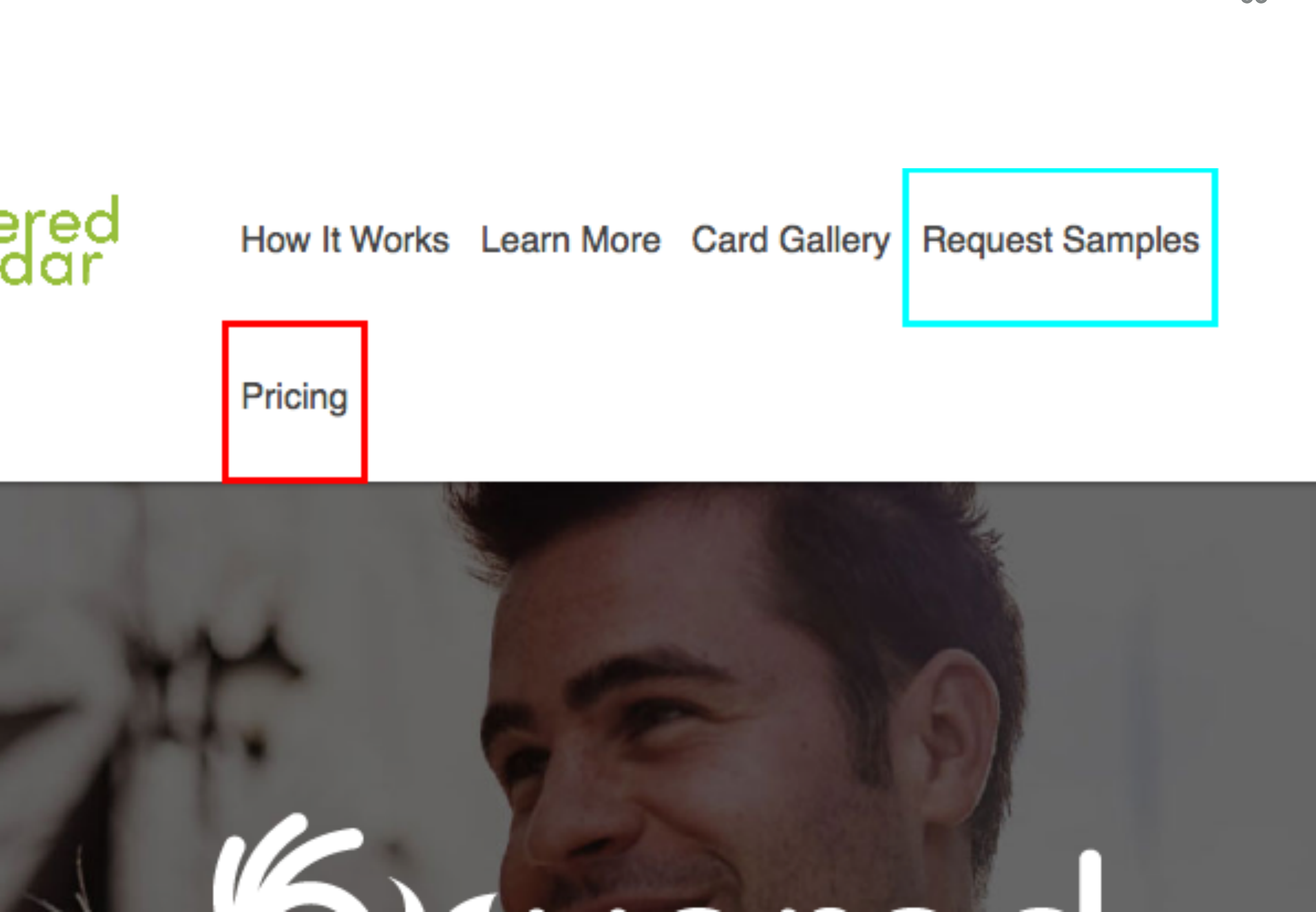
A Thoughtful Solution For Any Occasion

Send a custom greeting card to those special to you

ered
dar

How It Works Learn More Card Gallery Request Samples

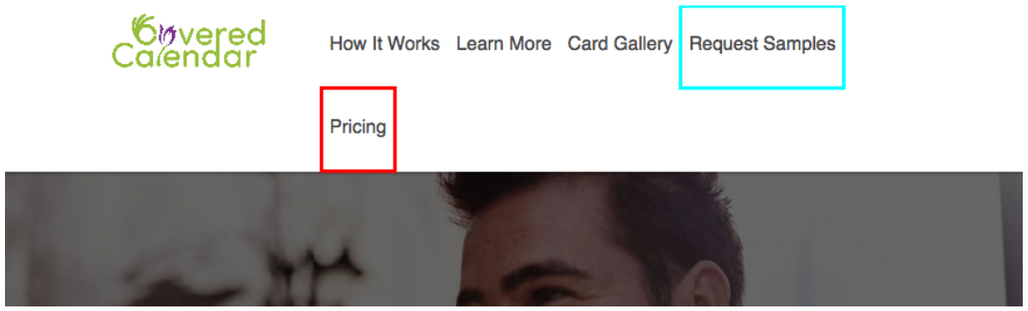
Pricing

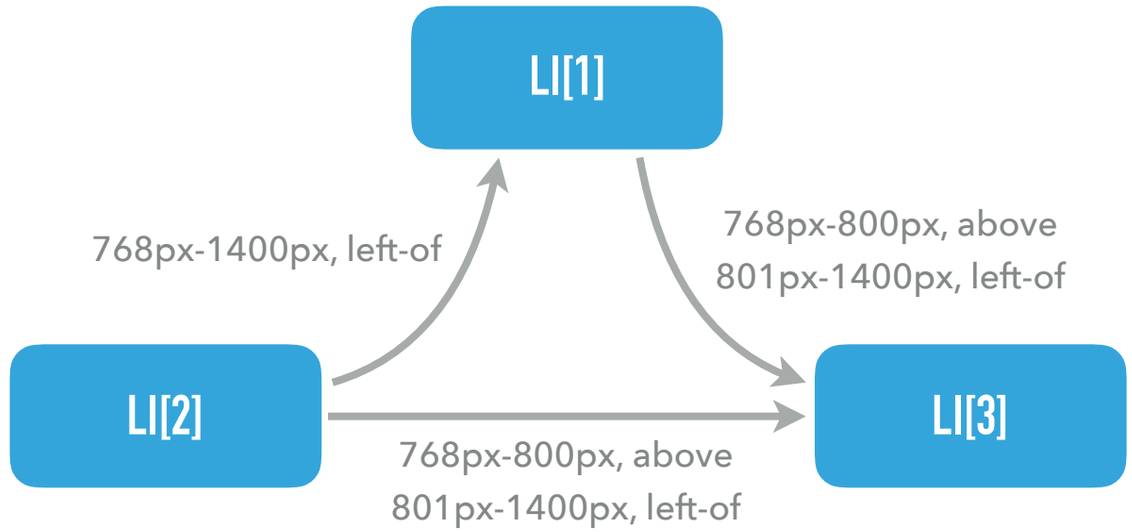


RLF 5 – ELEMENT WRAPPING

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



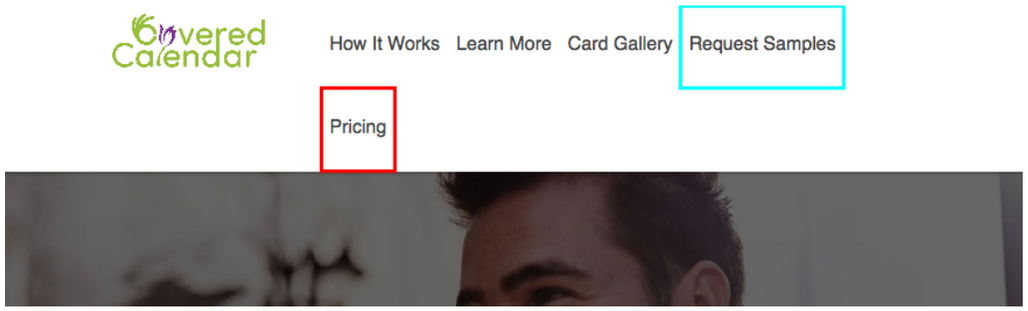


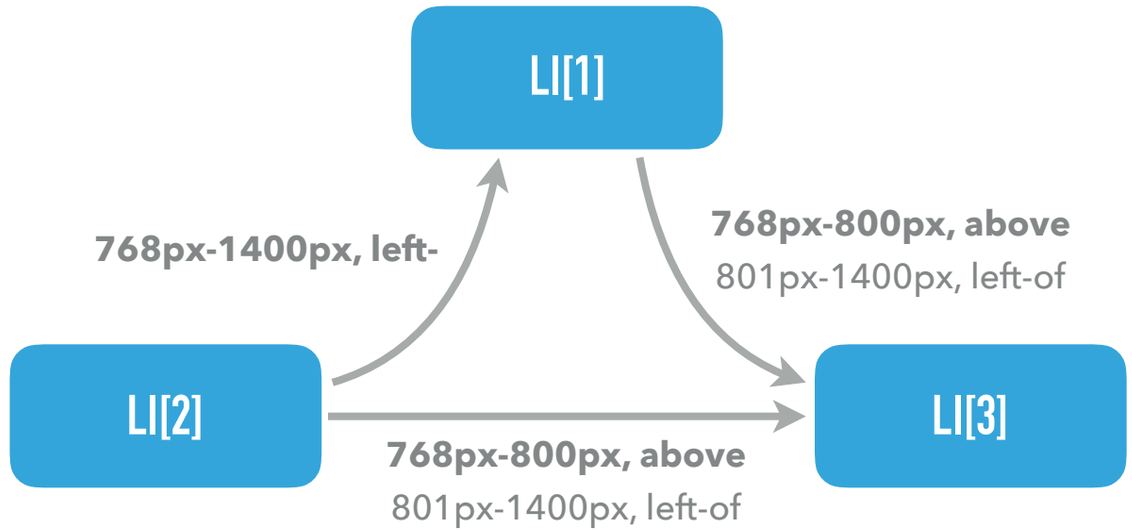
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

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





THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

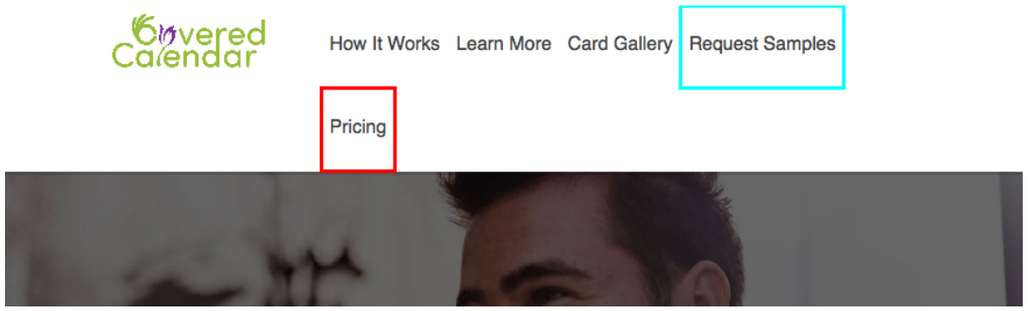
RLF 5 – ELEMENT WRAPPING

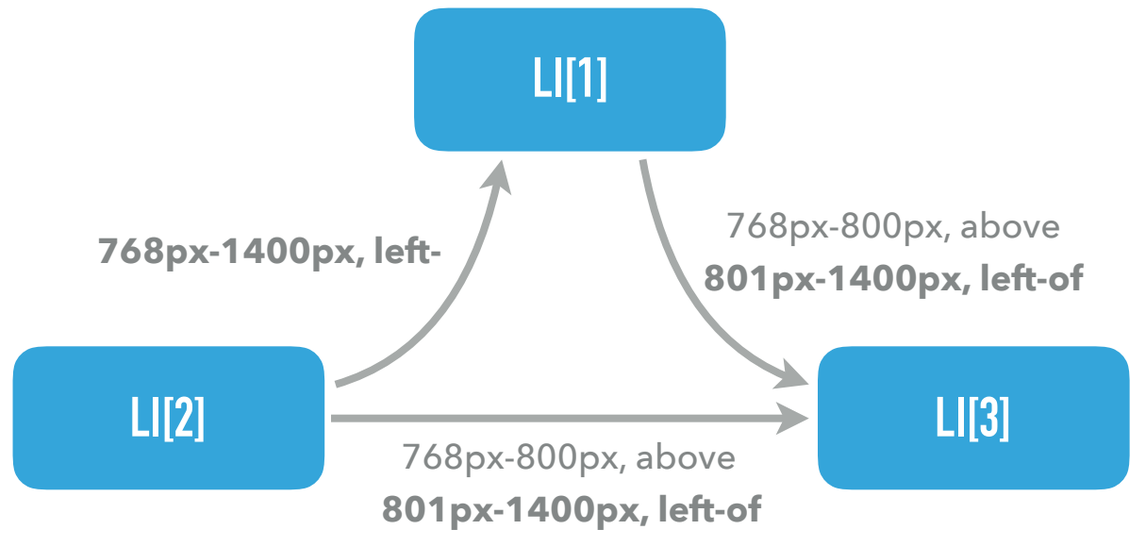
1. Analyse layout information to determine which elements are laid out in rows.

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



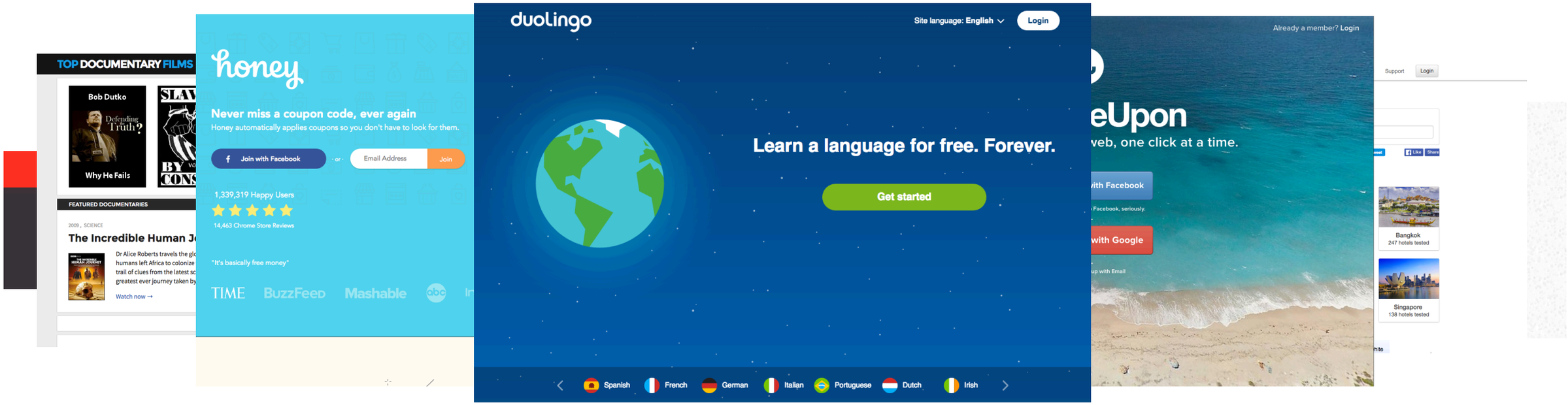


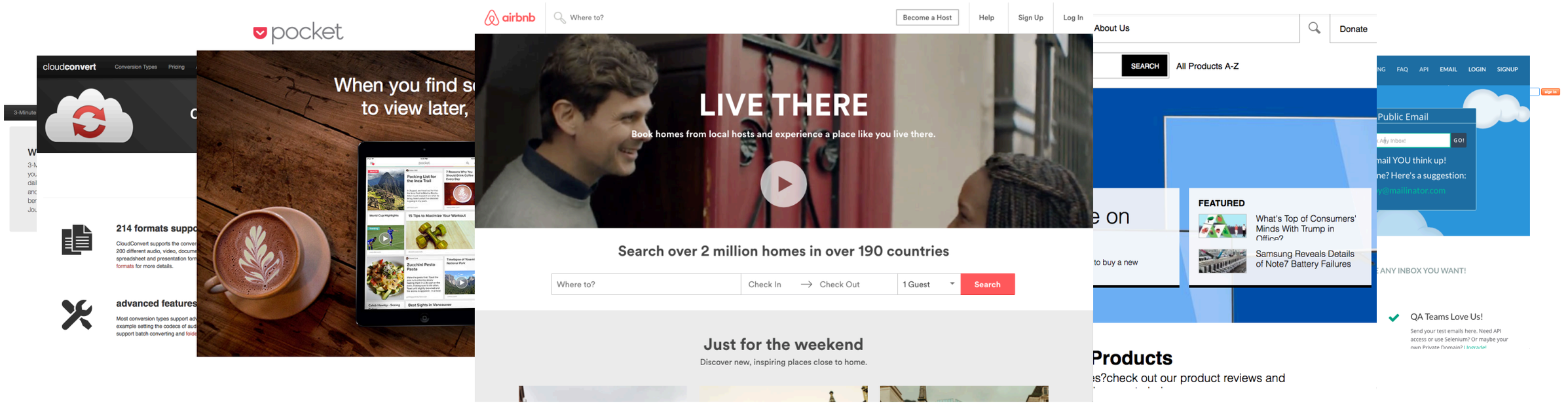
Element wrapping between 768px and 800px.

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 - **Re**sponsive **De**sign **Check**er





THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RQ1

CAN THE APPROACH DETECT RESPONSIVE LAYOUT FAILURES IN REAL-WORLD RESPONSIVE WEB PAGES?

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK


NUMBER OF USERS
22 MILLION
POCKET BY THE NUMBERS
2 BILLION
NUMBER OF ITEMS SAVED


NUMBER OF USERS
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.

Failure Type	TP	FP	NOI	RLFs
Element Collision	8	0	24	8
Element Protrusion	3	0	36	3
Viewport Protrusion	24	0	23	11
Small-Range	152	43	0	1
Wrapping	10	5	0	10
Total	**196**	**48**	**83**	**33**

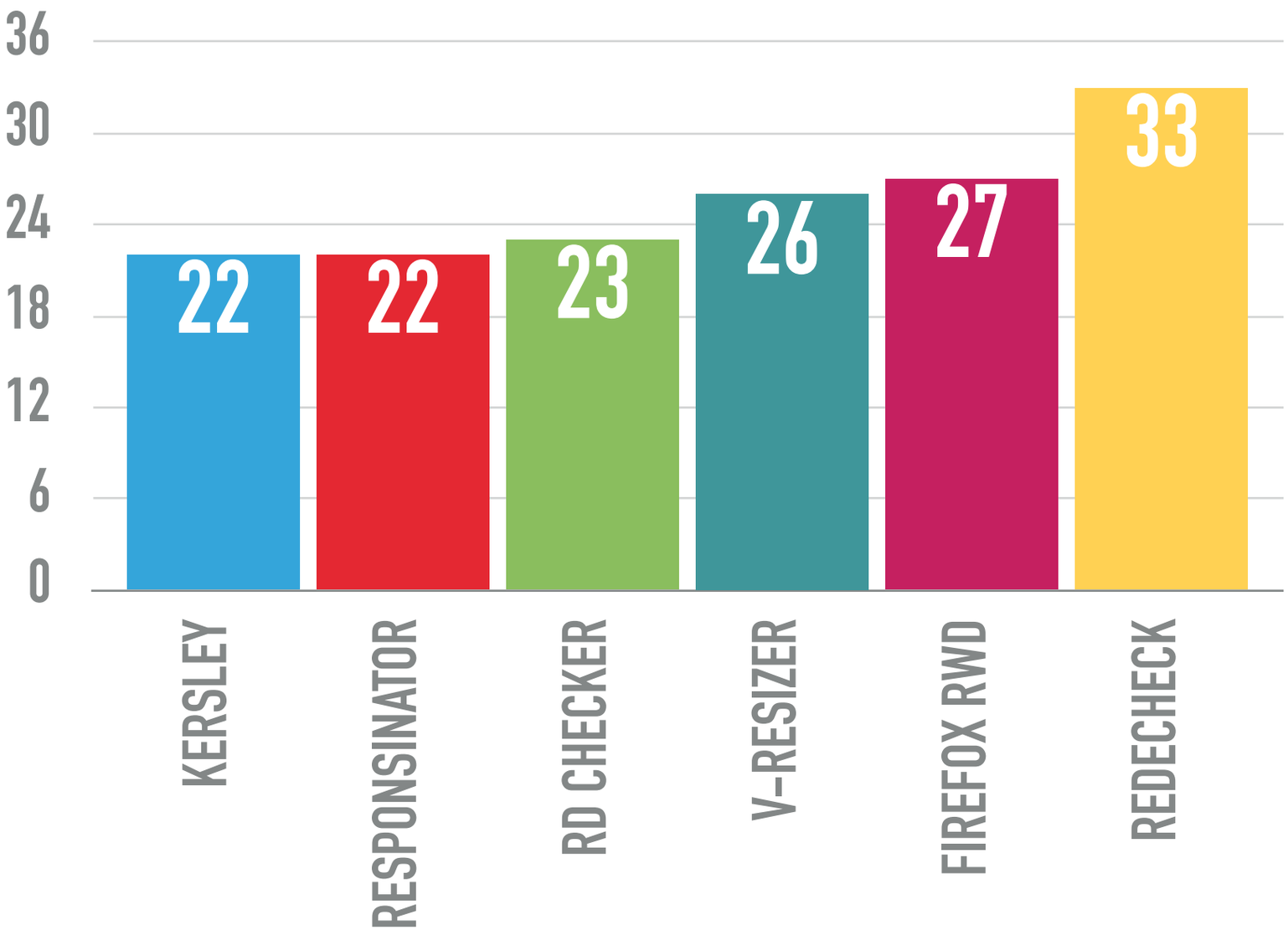
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RQ2

HOW EFFECTIVE ARE MANUAL "SPOTCHECKING" APPROACHES IN COMPARISON TO OUR APPROACH?

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RESEARCH QUESTION TWO



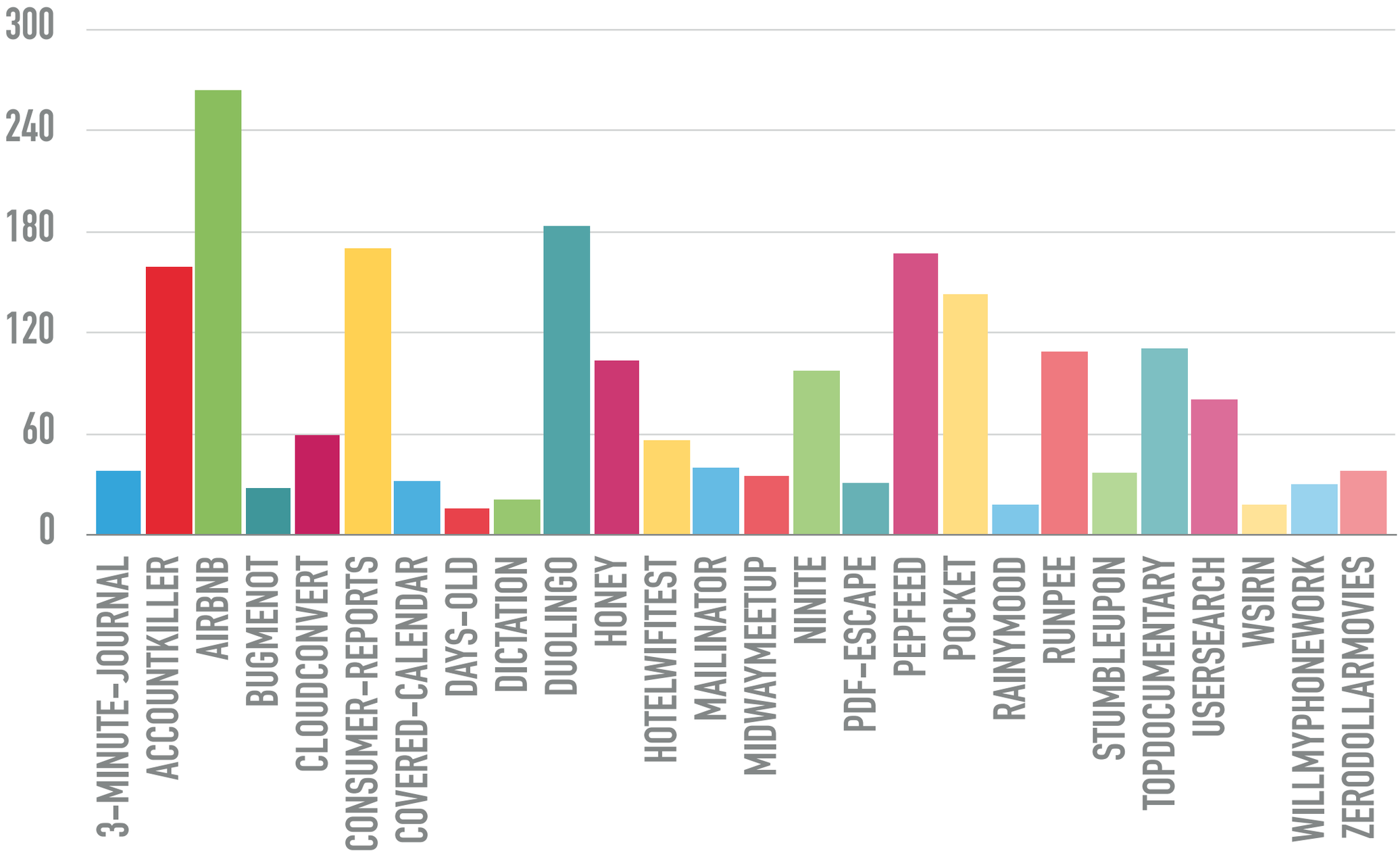
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

RQ3

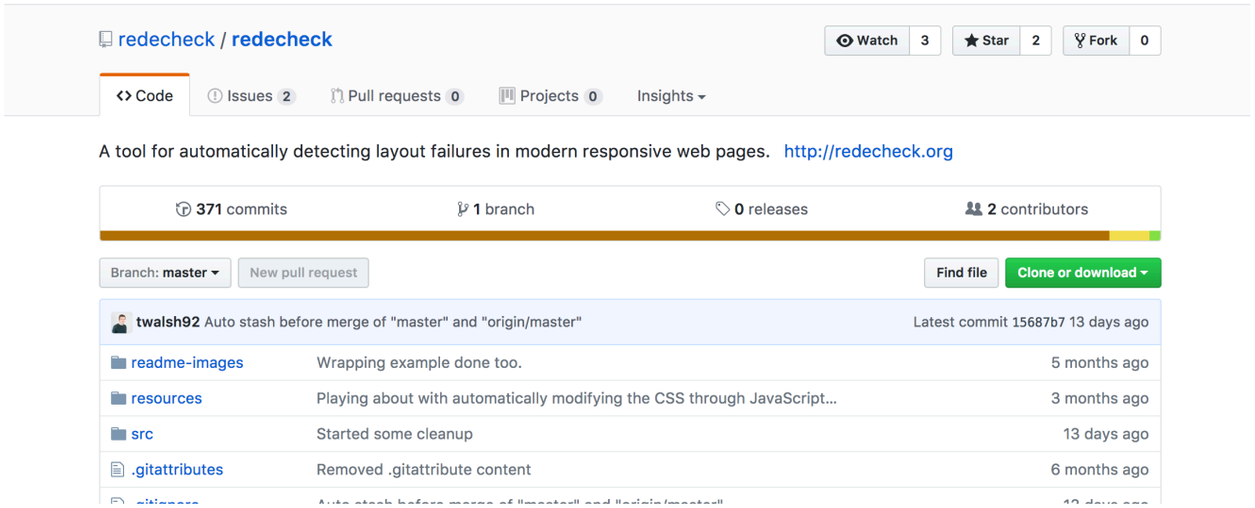
HOW LONG DO OUR TECHNIQUES TAKE TO RUN?

THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

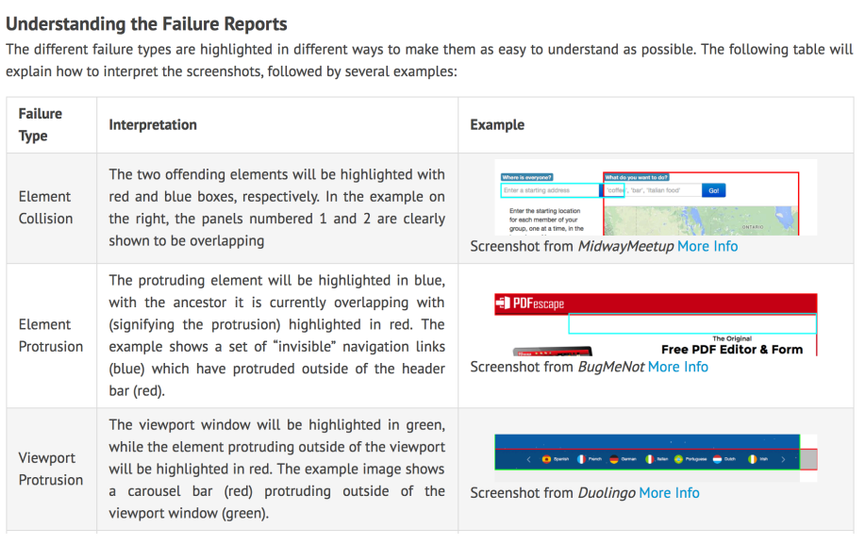
RESEARCH QUESTION THREE



THE REDECHECK TOOL



https://github.com/redecheck/redecheck

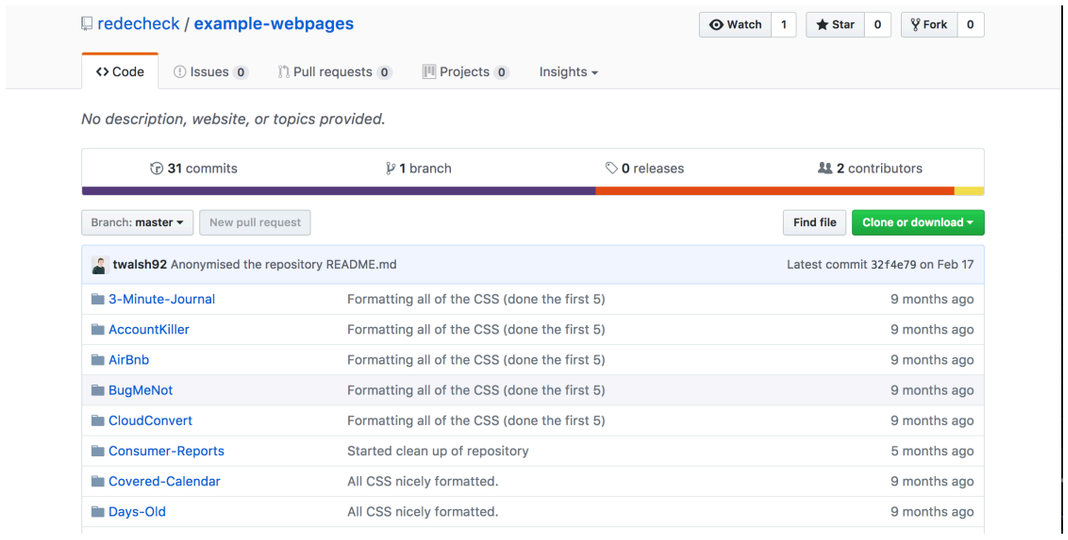


Understanding the Failure Reports

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:

Failure Type	Interpretation	Example
Element Collision	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	Screenshot from *MidwayMeetup* More Info
Element Protrusion	The protruding element will be highlighted in blue, with the ancestor it is currently overlapping with (signifying the protrusion) highlighted in red. The example shows a set of "invisible" navigation links (blue) which have protruded outside of the header bar (red).	Screenshot from *BugMeNot* More Info
Viewport Protrusion	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).	Screenshot from *Duolingo* More Info

http://redecheck.org

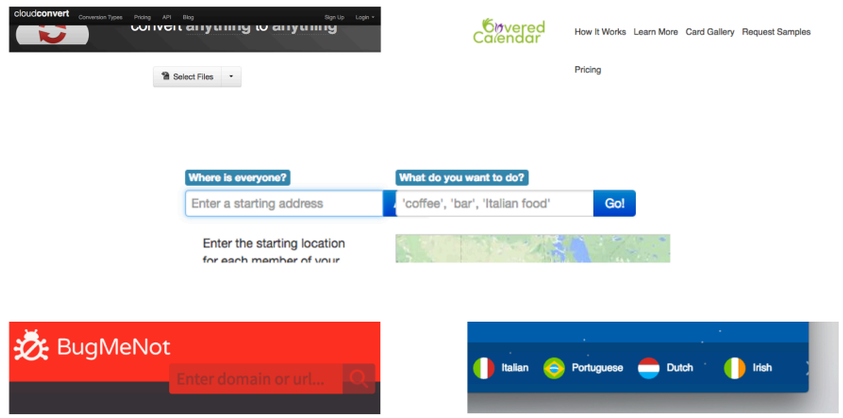


https://github.com/redecheck/example-webpages

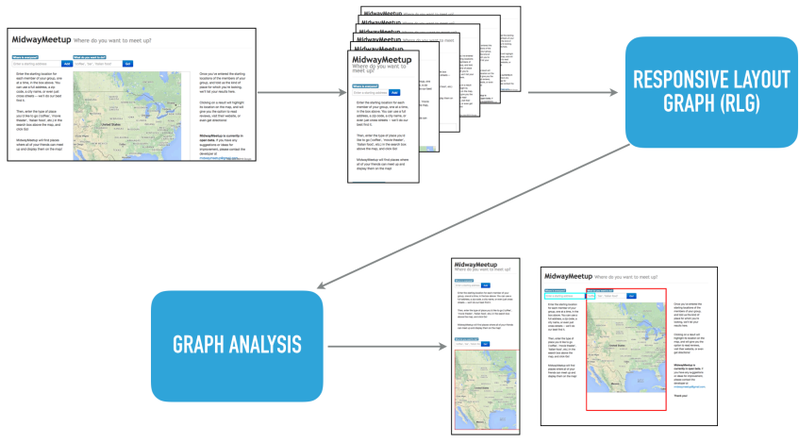
THOMAS WALSH
TWALSH1@SHEFFIELD.AC.UK

THE WEB TODAY

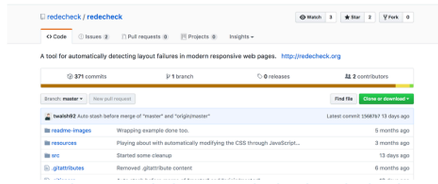
RESPONSIVE LAYOUT FAILURES



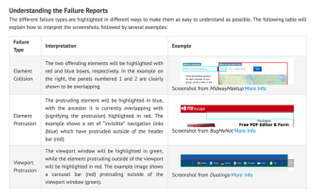
SUMMARY OF APPROACH



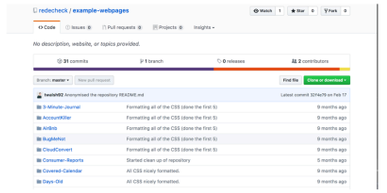
THE REDECHECK TOOL



https://github.com/redecheck/redecheck



http://redecheck.org



https://github.com/redecheck/example-webpages

THANK YOU

TWALSH1@SHEFFIELD.AC.UK
THOMASWALSH.CO.UK
REDECHECK.ORG